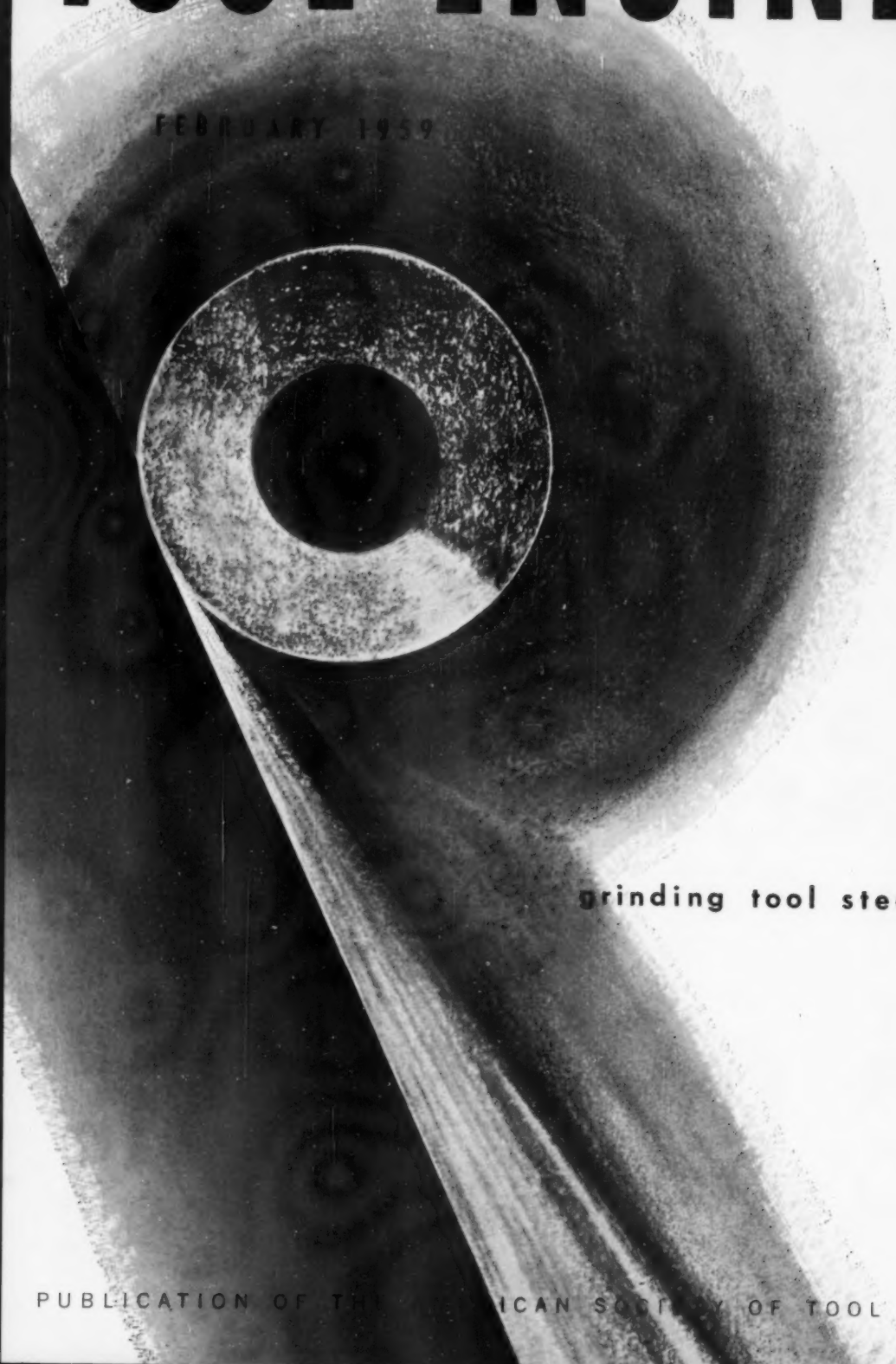
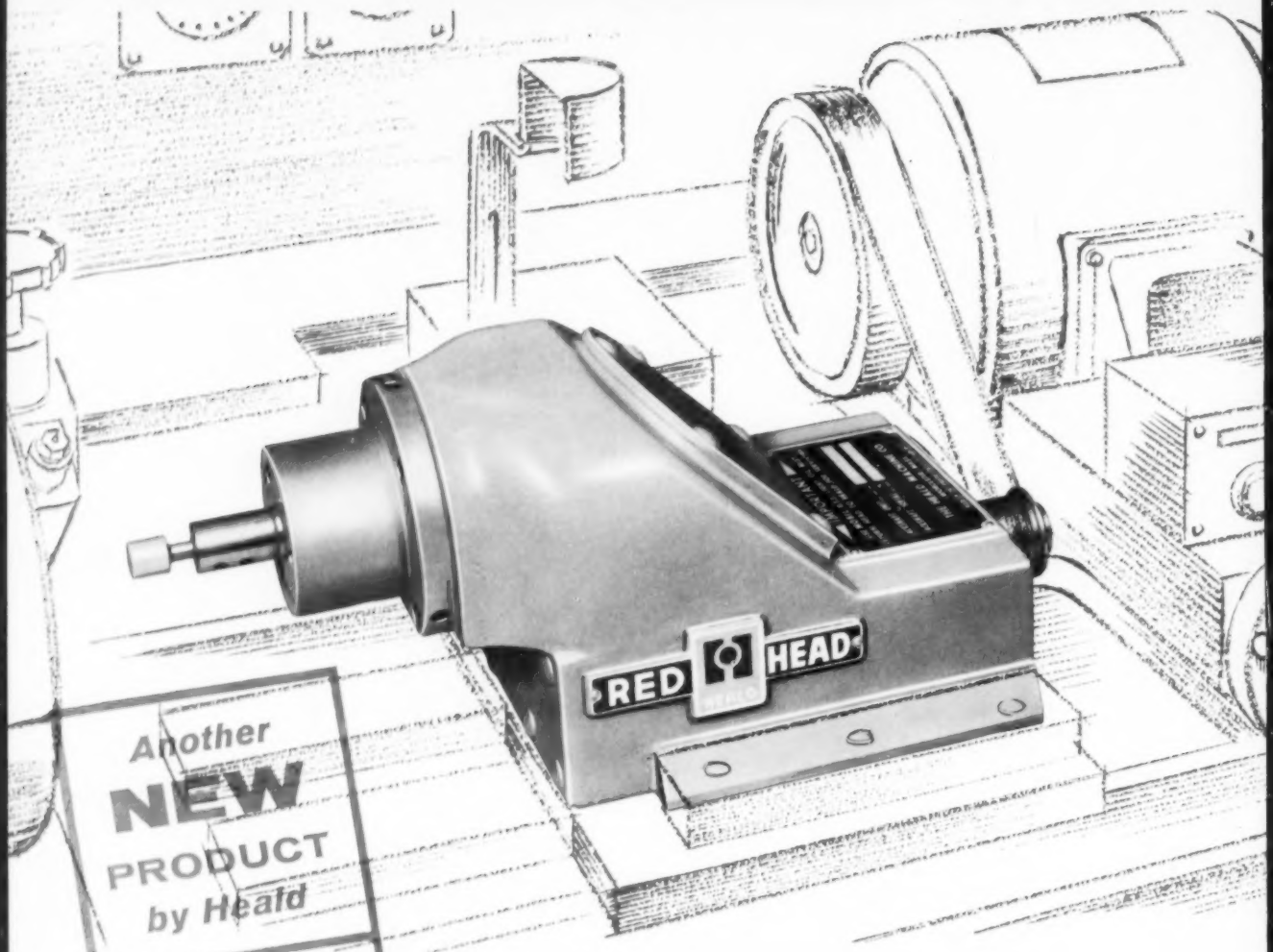
the TOOL ENGINEER

FEBRUARY 1959



grinding tool steel

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



Another **NEW** PRODUCT by Heald

☐ File for Reference
☑ Send for Bulletin

Now—for the first time—

a HI-SPEED BELT-DRIVEN WHEELHEAD

for speeds to 100,000 rpm

THE NEW Heald Red Head Hi-Speed belt-driven wheelhead offers a practical, *low-cost solution* to the problem of getting proper wheel speeds for small hole work where high frequency generating equipment is not available. It provides speeds from 45,000 to 100,000 rpm with simple belt drive from a standard electric motor!

The basic wheelhead consists of a jackshaft and body unit and a spindle cartridge. Two easily interchangeable spindle cartridges are available — one for speeds of 45,000, 52,000 and 60,000 rpm; the other for 70,000, 85,000 and 100,000 rpm. The three speeds for each spindle cartridge are obtained simply by changing the drive pulley on the rear end of the jackshaft.

Built to the highest standards of accuracy and precision, this latest addition to the Heald Red Head line opens up a new area of internal grinding operation in the small hole class hitherto impossible without special equipment. Ask your Heald representative for complete information. Or send for a copy of Bulletin 6-3.

HEALD

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

the tool engineer

Vol. 42, No. 2 **February 1959**

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Material, labor and overhead costs all affect tooling decisions. Knowing these costs is the first step toward improved plant efficiency.

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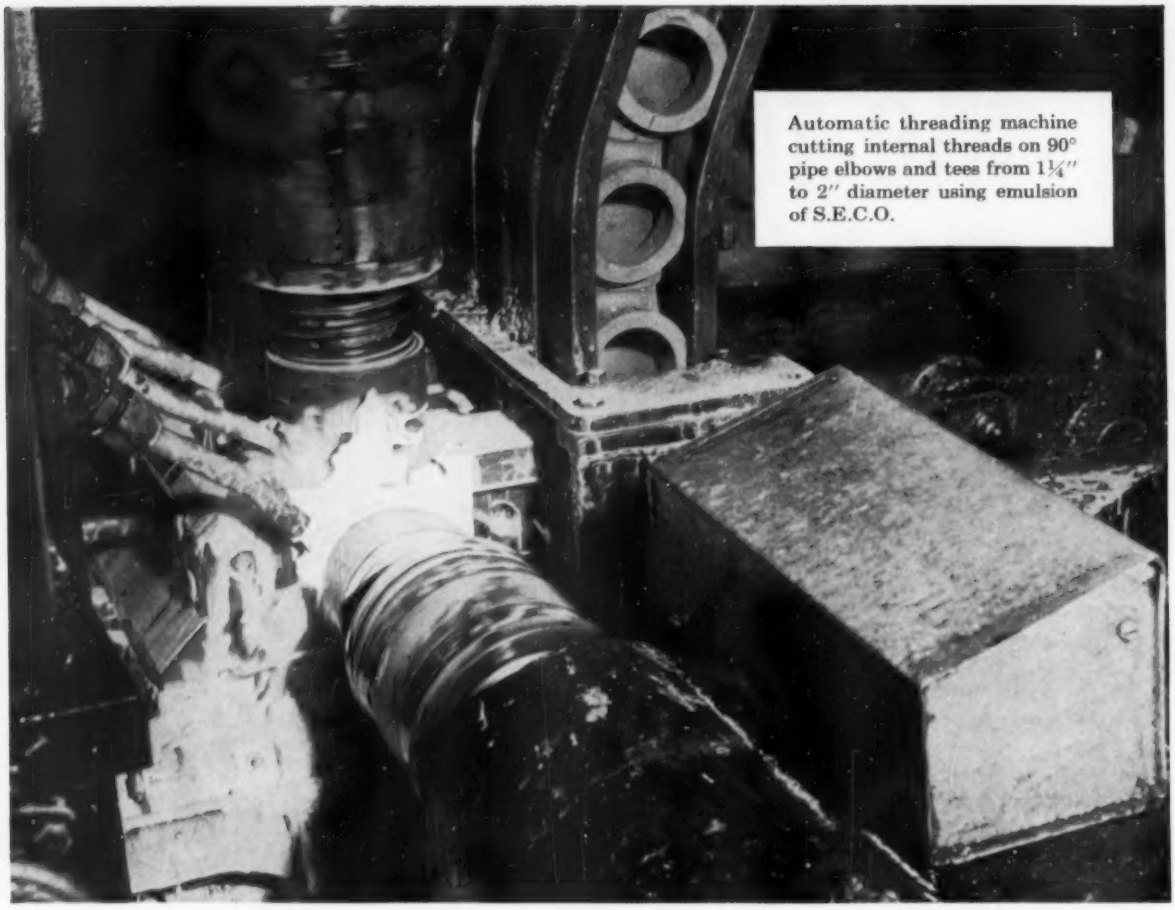
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THIS MONTH'S COVER

Grinding wheel life can be extended or grinding speeds increased by using free-machining tool steels instead of conventional types. A typical surface grinding operation is shown in this stylized treatment by cover artist William Solms. Details of research results on grinding sulfurized tool steels are contained in the article starting on page 77.



THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*.



Automatic threading machine cutting internal threads on 90° pipe elbows and tees from 1¼" to 2" diameter using emulsion of S.E.C.O.

Photo courtesy of Grinnell Corporation

NEW S.E.C.O. EMULSIONS, WITH SMALLER OIL-PARTICLE SIZE, CUT PRODUCTION COSTS

There's a new and greatly improved S.E.C.O. (Sunoco® Emulsifying Cutting Oil), that has smaller emulsion-particle size to give you the following benefits:

- BETTER PROTECTION AGAINST RUST, even at emulsion ratios as lean as 40-to-1.
- BETTER DETERGENCY, which permits dirt and fines to settle quickly out of emulsions, leaving machines clean.
- BETTER EMULSION STABILITY. Even in hard-water areas, emulsions of *new* S.E.C.O. stand up better than those made with other regular emulsifying cutting oils.
- BETTER FINISHES, CLOSER TOLERANCES. New S.E.C.O., with better coverage and wetting of work, produces consistently finer finishes in machining. Reject rate falls off. Tool life increases.

TRY *NEW* S.E.C.O.—for increased economy in all machining operations. Ask your Sun representative, or write to Department TE-3.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

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It Couldn't Be Done

We tried that and it didn't work! Often that is the response to suggestions for improving a process or method. It also is the frequent reaction to a report presented at a technical meeting or published in an engineering journal. Unfortunately, such reactionary viewpoints sometimes stop investigations that could have been successful.

Does the person making such a statement realize his responsibility or is he only interested in maintaining status quo for his own imagined security? Improvements in materials and methods alone may make the suggestions workable to say nothing of the possibilities of a new design approach. Young engineers can be resourceful because they do not have the inhibitions of some older ones. They are not afraid to try.

Original mass production is accredited to Eli Whitney for his production of rifles for the Government. His original thinking is still the backbone and inspiration of our modern production methods. Yet in gun manufacture, hand filing operations are still being used. Also, wood sticks with abrasive cloth are being employed for polishing the gun bore.

Because it couldn't be done, one manufacturer is now finishing the bore of shotguns by using only drilling and honing operations without intermediate reaming. Many seasoned specialists predicted failure, saying that reaming and hand finishing were essential. Instead, the special machine for honing is capable of finishing the bore with greater accuracy, finer finish, and less cost than was ever possible previously.

John W Greve

EDITOR

COGSDILL TWIST DRILL

the name to remember for quality . . .

to watch for progress



We are pleased to announce that effective immediately the Cogsdill Twist Drill Co., Inc., will be operated as a wholly owned subsidiary of The Sheffield Corporation, Dayton, Ohio.

A complete line of drills and center drills will be manufactured in Greenfield, Massachusetts and will be distributed nationally by the same Cogsdill Distributors who have been serving industry in the past. Cogsdill's "Micro-Limit" countersink and other special cutting tools will not be included.

Cogsdill's Mercury, Black Panther, Economy and Chip-Flow trade names have been synonymous for quality and performance for 46 years and we pledge that these fine products will continue to give the same outstanding service and performance under our new organization.

COGSDILL TWIST DRILL CO., INC., Greenfield, Massachusetts

HARDINGE
ELMIRA, N.Y.

STANDARD EQUIPMENT
in
Progressive Screw Machine Plants

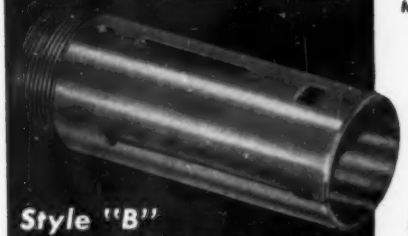
The Only MASTER COLLET
With No Work Pressure on the Screw.

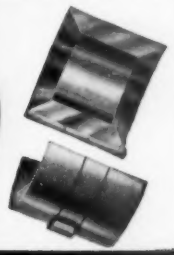


Style "S"
Master Collets and Pads



Pads Interchangeable
Among Different
Makes of Automatics



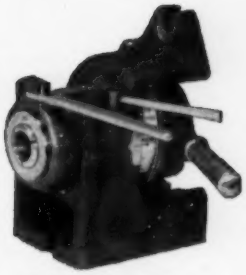


Style "B"
Master Feed Fingers and Pads

HARDINGE BROTHERS, INC., Elmira, N. Y.



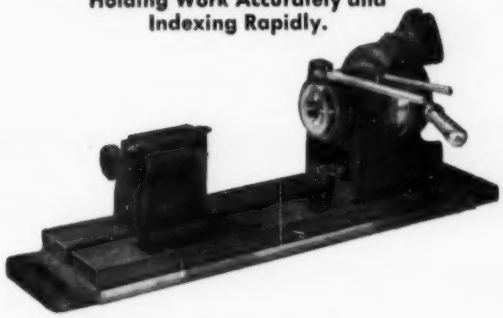
H-4 Tool Room-Inspection



HV-4 Production

HARDINGE
COLLET INDEX FIXTURES

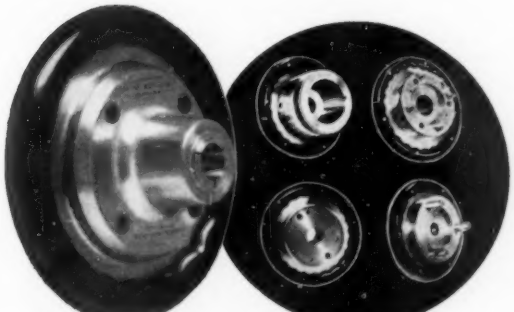
Increase Production by
Holding Work Accurately and
Indexing Rapidly.



HARDINGE BROTHERS, INC., Elmira, N. Y.

HARDINGE-SJOGREN
Speed
COLLET CHUCKS

Fast — Accurate
Increase Production Capacity



Available in 1¼"; 1⅜"; 2¼"; and 3½" collet capacity. Threaded nose, cam lock, tapered key-drive and American Standard spindles. *Write for Bulletin 8A.*

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COLLETS
for
LATHES and MILLERS



ACCURACY — DURABILITY — LOW COST

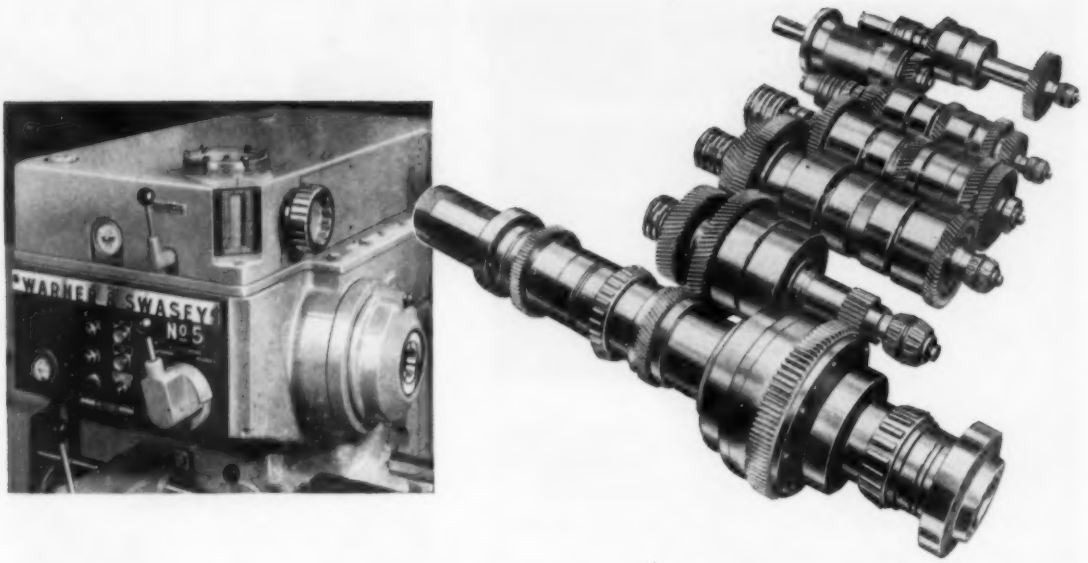


Write for Bulletin 56 —
Complete collet ordering
information for all Lathes, Millers, Grinders and Fixtures



HARDINGE BROTHERS, INC., Elmira, N. Y.

Immediate stock delivery from Elmira, Boston, Atlanta, New York, Hartford, Philadelphia, Rochester, N. Y., Dayton, Detroit, Minneapolis, Chicago, St. Louis, Oakland, Los Angeles, Toronto, Montreal.



INSTANTANEOUS SPEED CHANGES

WITH THE FLIP OF A LEVER

DIRECT-ACTING hydraulic clutches, with a constant-mesh gear train, eliminate all gear shifting on these new Warner & Swasey No. 4 and No. 5 Ram Type Turret Lathes. Clutches engage smoothly and quickly, providing fast starts, stops, and reverses. Clutches never need adjustment.

With the patented speed preselector the operator can preselect speeds and with a mere flip of a lever, change speeds instantly.

A flip of the speed change lever in the opposite direction provides a valuable 6 to 1 speed reduction for threading or forming cuts —instantly and without preselection.

A total of 12 spindle speeds, or 24 unduplicated speeds with a two-speed motor, is available on these new machines. A touch of a button doubles or halves the speed, and when used in conjunction with the 6 to 1 speed change, four spindle speeds are instantly available with only one setting of the preselector.

A separate master lever controls forward, reverse, brake and neutral. *Zoned controls* on headstock and apron put them all within easy reach of the operator—cutting fatigue, speeding his work, putting more pieces on the floor every hour of every day!



Warner & Swasey's direct-reading, patented speed preselector is calibrated in work diameter, surface feet, and spindle rpm's—which, with the new ease of changing speeds, encourages the operator to use the proper spindle speed.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

Get the right abrasive for your flat surface grinding with the Gardner Service Plan

Only Gardner combines abrasive and machine experience, because only Gardner makes both! And Gardner Abrasives Specialists concentrate on disc grinding. For maximum production, longer disc life, investigate the Gardner Service Plan:



1

A survey of your grinding operations.



2

An actual in-service trial of Gardner Discs.



3

A close check of the results.

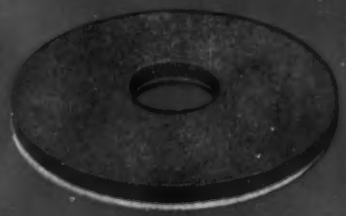
The Gardner Abrasives Specialist in your area will call at your request.

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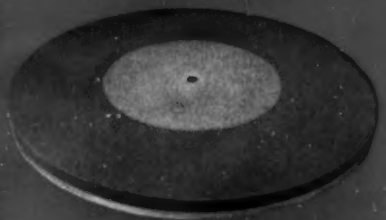
abrasive discs

BELOIT, WISCONSIN

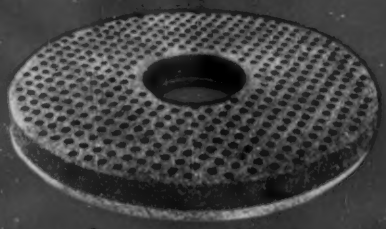
Gardner WIRE-LOKT® discs



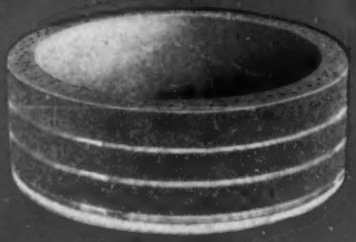
smooth face



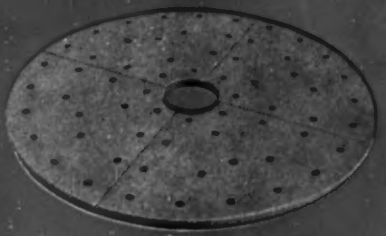
combination grade



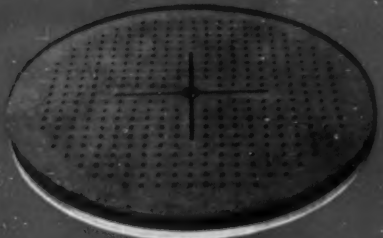
deep corrugated



cylinder type



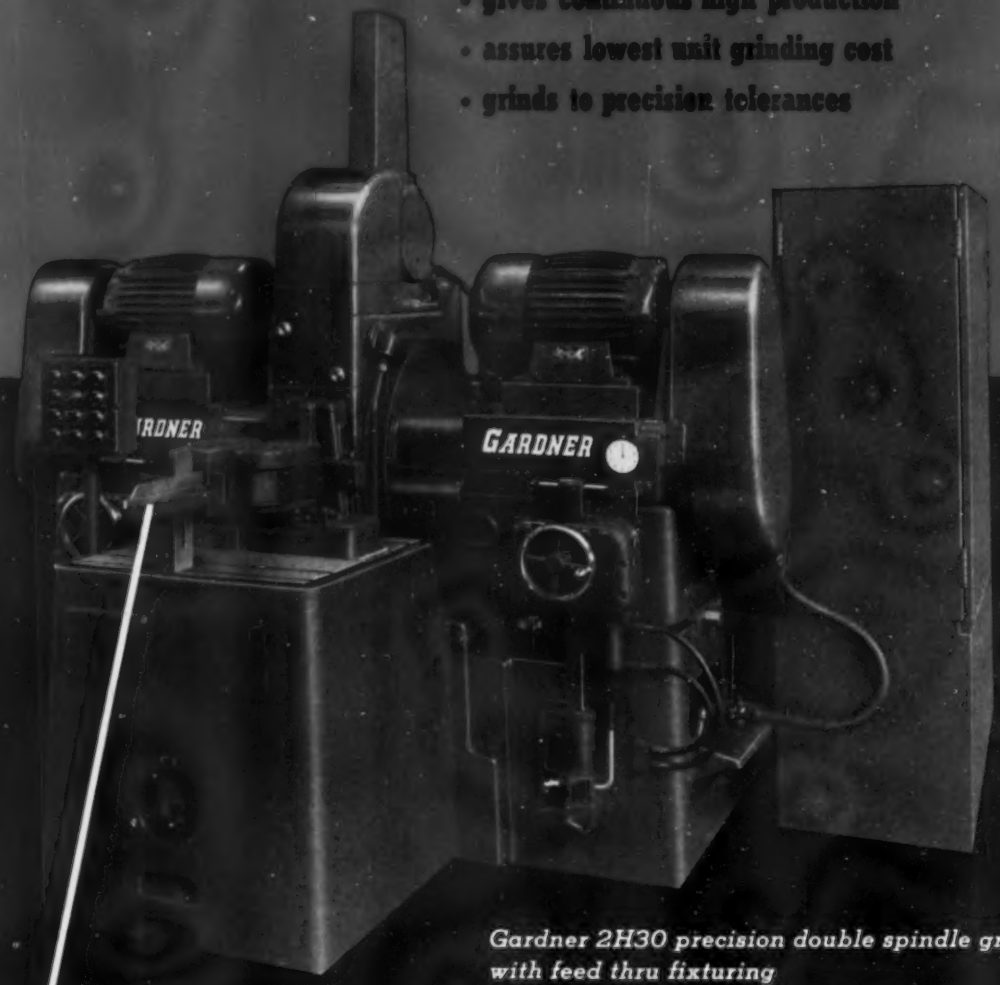
segmental



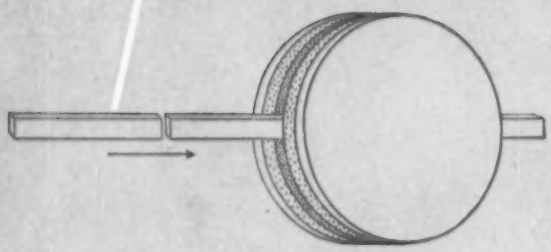
deep corrugated with radial lines

Disc grinder finishes two parallel surfaces in one operation

... Gardner grinder with feed thru work fixture
- gives continuous high production
- assures lowest unit grinding cost
- grinds to precision tolerances



Gardner 2H30 precision double spindle grinder with feed thru fixturing



Feed thru double disc grinding

Typical parts:	bearing races, covers, plates, runner bars
Production:	2000 to 6000 parts per hour
Stock removal:	.010" to .020"
Flatness:	.0001" to .0006"
Parallelism:	.0001" to .0007"
Uniformity:	.0008" to .001"

GARDNER

precision disc grinders

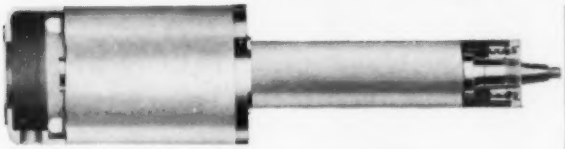
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SEE FOR YOURSELF

why you can be sure of...

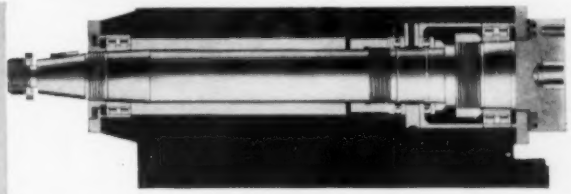
- **LOW MICROINCH SURFACE FINISHES**
- **TOLERANCES DOWN IN THE MILLIONTHS**
- **INCREASED PRODUCTION**
- **LOWER COSTS**

when you specify... **POPE PRECISION SPINDLES**



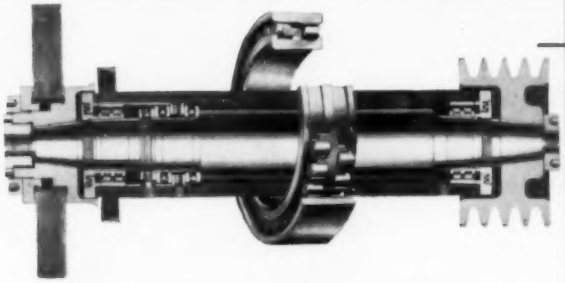
FOR SURFACE GRINDERS—

POPE 1, 2 and 3 HP, Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with massive shafts and big, double row cylindrical roller bearings having enormous capacity, superior performance and long life.



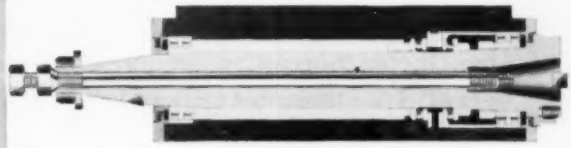
FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH

POPE Heavy Duty Boring Spindles for smooth, chatter free, continuous high production of accurate parts. Again, look at the big cylindrical roller bearings and thrust bearings.



FOR CYLINDRICAL GRINDING—

POPE Cartridge Type and Wheel Head Belt Driven Spindles with the capacity to produce more work whether you plunge grind with a crush dressed wheel, remove surplus metal, or produce low microinch surface finishes. Note the super-precision radial bearings and ball thrust bearings.



FOR HEAVY DUTY MILLING—

POPE Spindles have the double row cylindrical roller bearings for the extra rigidity to support the cutting tool, and the double direction thrust bearings with the excess capacity to stabilize the shaft against endwise movement in either direction. This adds up to longer cutting tool life, more production, lower cost per piece.

POPE engineers and builds standard and special, precision anti-friction bearing Spindles for every purpose. Send us your specifications for prompt quotations.

No. 115

Specify **POPE®** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

Now you can do **both** . . .

SHORT RUNS

LONG RUNS

. . . Drilling and/or Tapping . . .

with ONE adjustable U. S. Drill Head

Complete versatility for job shop operations with standard adjustable arms . . . or, equip these heads with U. S. Slip Spindle Plates which are jig-bored for positive alignment to fit the hole pattern. Eliminates trial-and-error in set up.

Double Duty Tools—when your drilling machine has a reversing spindle, you can drill and tap the same hole pattern with one head.

U. S. Drill Heads are fast and rugged—designed and built for profit-making performance. Positive all-gear drive with shaved gears, anti-friction bearings, and oil-tight housings assure smooth and accurate operation.

Ask for Catalog AD-57, or send specifications of your requirements.



Slip Spindle Plates may be jig-bored for more than one pattern of holes.

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO



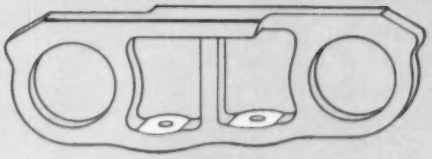
This job is a "natural" for broaching . . .

and the V-3 VERTICAL PULL-DOWN LAPOINTE

BROACHING MACHINE

is so efficient that it pays its way

although working only 1/3 of its available time!

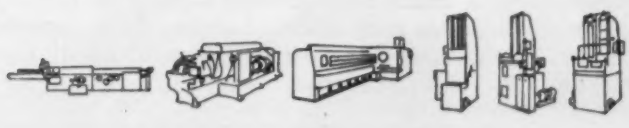


Steel forgings are tough to machine, but one of the world's largest producers of road-building equipment has substantially reduced production costs by Lapointe-Broaching the nut seats in steel-forged track links. Two 1¼" wide x 5/16" deep internal nut seats are broached in each link. Production is 170 complete links per hour, at 80% efficiency. And the interesting part of it all is that the investment in this Lapointe machine is paying off even though the broach *stands idle for two-thirds of the time!* . . . In your own shop there may be difficult operations that can be converted to Lapointe-Broaching from milling, shaping, etc., with an *improvement in quality, increased production . . . and lowered costs.* Why not invite an experienced Lapointe Field Engineer to call on you?

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

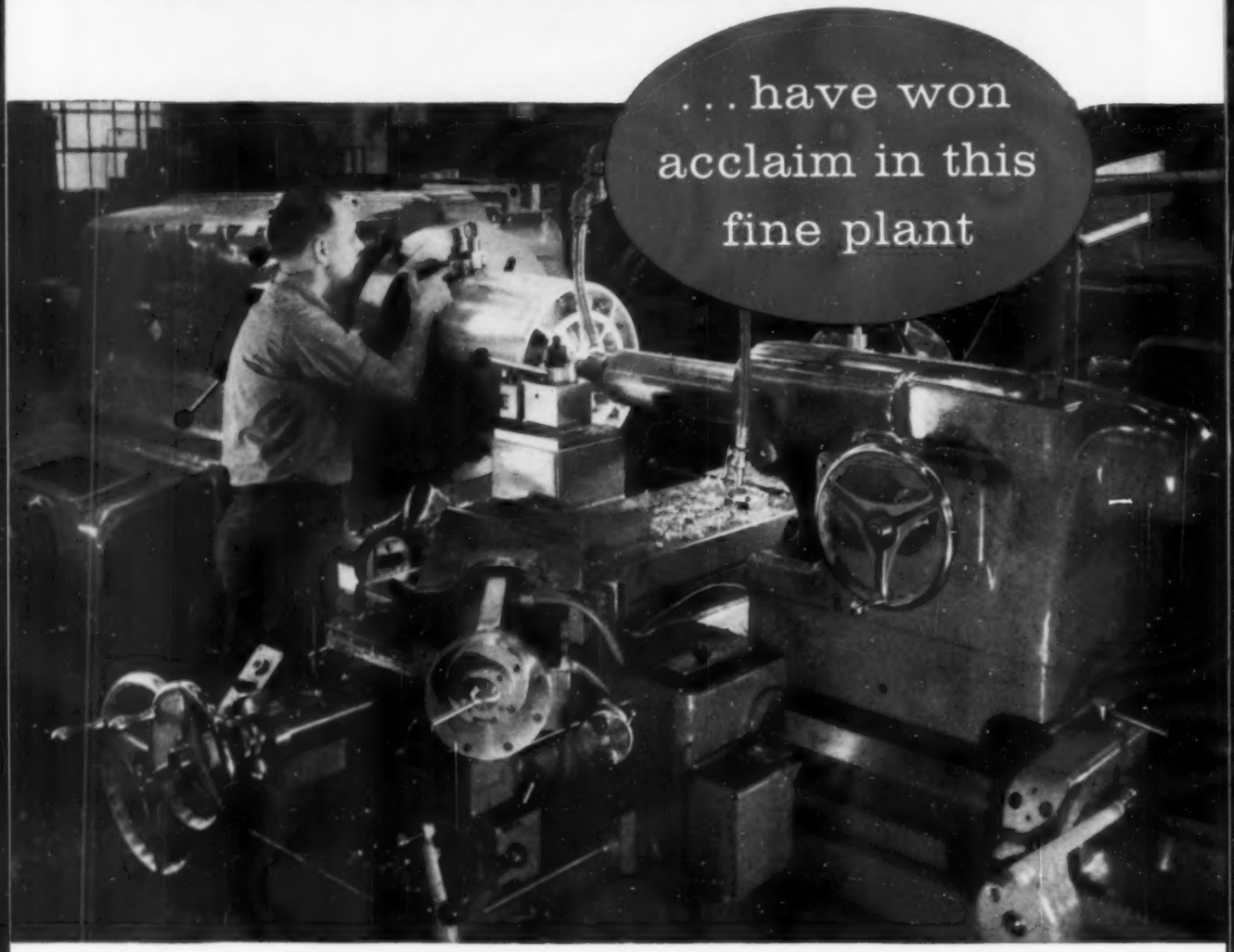


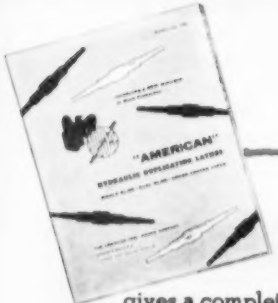
LAPOINTE

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"American" TRACER LATHES





Bulletin
No. 135

gives a complete description
and shows many examples.
It's yours for the asking.

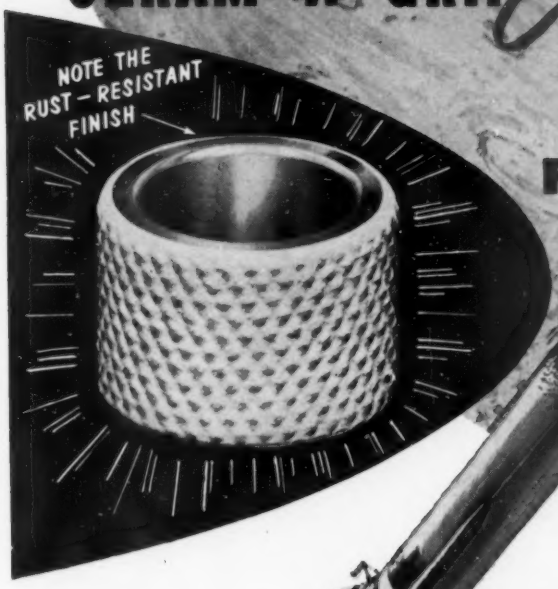
The Mechanical Division of General Mills, Inc. in Minneapolis, Minnesota uses "AMERICAN" Tracer Lathes for their contouring work. 17 years of ordnance and instrument work have conclusively demonstrated to the General Mills officials that only the highest quality equipment can produce the precision work that their contracts require—result "AMERICAN" selection.

More production per man hour is the answer and only answer to spiraling costs—modern, high production machinery is the answer to greater production per man hour. Judging from reports, the Mechanical Division of General Mills, Inc. has found this to be true.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

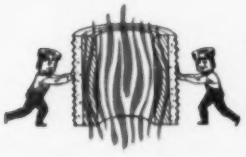
LATHES AND RADIAL DRILLS

CERAM-A-GRIP® American's New ceramic Precision Drill Bushing for PLASTIC TOOLING



CERAMICS — used as a barrier against the tremendously high temperatures encountered by the nose cones on ballistic rockets, has been adapted by the American Drill Bushing Co. to a line of precision drill bushings for use in plastic tooling. The Ceram-A-Grip bushing gives a maximum of protection against bushing misalignment and spin out, with a minimum sacrifice of close hole spacing.

EXCITING new development from the Space Age Laboratories



DO YOU HAVE A FRICTIONAL HEAT PROBLEM? THE THIN CERAMIC SHELL PROVIDES AN EFFECTIVE HEAT BARRIER! CERAMIC MATERIAL FUSED TO THE OUTER SURFACE OF THE PRECISION DRILL BUSHING EFFECTIVELY INSULATES THE PLASTIC POTTING MATERIAL FROM ANY EXCESS FRICTIONAL HEAT BUILD-UP IN THE BUSHING.



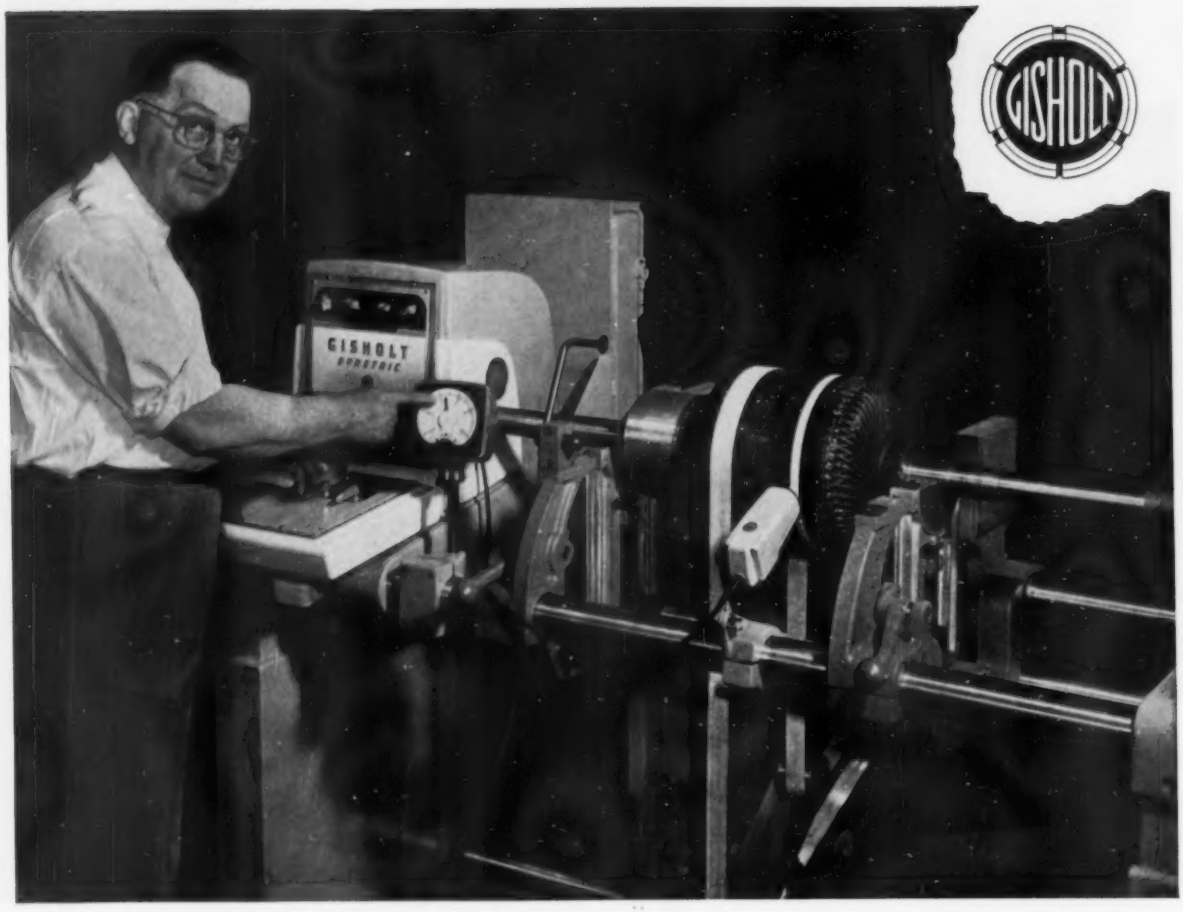
LOOK TO *American* FOR A COMPLETE LINE OF DRILL JIG BUSHINGS FOR PLASTIC TOOLING

SEND FOR CATALOGS AND COMPLETE INFORMATION



American DRILL BUSHING CO.
5107 Pacific Blvd. • Los Angeles 58, Calif.

Also ask for information on our new THINWALL line of regular drill bushings.



When a GISHOLT BALANCER tells you the story —you don't have to translate it!

Note that dial reading! It does more than you may suspect.

Unlike other balancing machines, it does not merely indicate amount of unbalance in arbitrary units and leave it to the operator to interpret in terms of correction. Gisholt Balancers can tell the story *directly* in terms of correction units. No translation needed. No computation. No charts or graphs.

Because of their infinitely variable sensitivity, Gisholt Balancers are easily adjusted for the job at hand. Correction units such as ⅛" lengths of wire solder, 1/64" depths for a certain size of drill, washers of a specific weight, etc., can be used. Readings, in terms of these units, are shown directly on the amount meter.

Think what that means in time saving alone! Yet this is only one of many ways Gisholt enables you to set—and maintain—higher standards for your balancing work.

If your product includes the use of rotating parts, by all means check Gisholt for the most recent information on balancing.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

DYNETRIC BALANCERS GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

NOW — POSITIVE PRECISION

for all bore inspection operations

NEW Starrett No. 84

DIAL BORE GAGES

SENSITIVE, ACCURATE, EASY TO USE
Ideal for all bore inspection operations and for checking hole sizes during machining or grinding.

WIDE MEASURING RANGES — ONLY 3 SIZES NEEDED
Three sizes cover the range of 3 to 12⅛ inches. Models available reading in ten-thousandths or half-thousandths.

LIGHTWEIGHT, COMPACT, EASY TO HANDLE
Designed for extreme sensitivity, exact duplication of repetitive readings, easy handling, low maintenance costs.

STURDY CONSTRUCTION, DURABLE FINISH
Indicator housing and contact head made of finest aluminum with gray wrinkle finish. Knurled aluminum handle with black finish. Steel connecting tube with smooth black finish.

SELF-CENTERING IN BORE
Adjustable range screw with positive locking feature and two centralizing plungers give three-point contact for true alignment.

BUILT FOR LASTING PRECISION
Gaging contact and centralizing plungers inserted in bronze bushings, range screw in steel sleeve. Contact, range screw and plungers made of tool steel, hardened and tempered for long wear . . . also available carbide tipped on special order.

EASILY ADJUSTED FOR WIDE RANGE
Range screw adjustable to suit hole diameter and interchangeable for wide measuring range. Can be operated over full range without readjusting setting of gage housing on extension tube.

RELIABLE ON REPEAT READINGS
Gaging contact and centralizing plungers spring loaded for sensitivity and repeatability.

Your Industrial Supply Distributor will gladly demonstrate the advantages of Starrett No. 84 Dial Bore Gages. Call him for quality products, dependable service . . . or write for Bulletin No. 419. Address Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

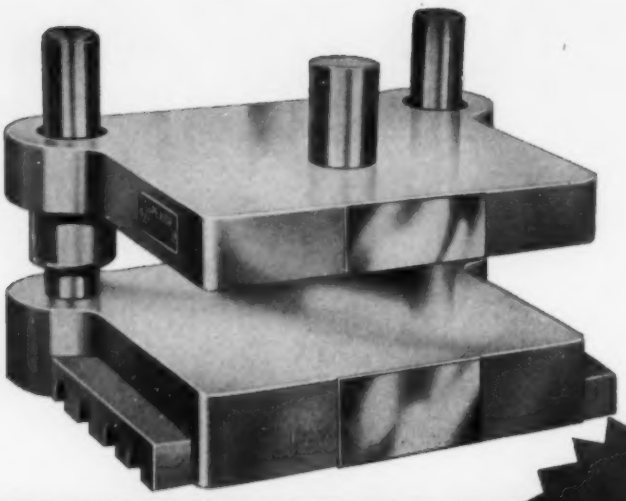


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SUPERIOR DIE SET Exclusives

SAVE TIME AND CUT OVERALL DIE MAKING COSTS!!

No fumbling or wasted time with large or small die sets when you use Superior. Assembly and disassembly of these precision sets is rapid. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging valuable press equipment.

All Superior Die sets are jig bored to your specifications—result number of die set sizes practically limitless.

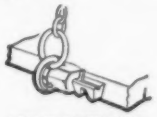
Add to this such outstanding features as *Precision Center Marks, Long and Short Bushings, Superfinish Pins* and you can see why Superior is your best die set buy.

Write today for 24 page catalog.



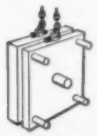
SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe.



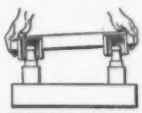
LOCK-JAW LIFTING DEVICE

removes the danger of handling large die sets.



E-Z LIFT SLING CHAIN

attach to the lock-jaw for immediate lifting.



"REMOVABLE CAP" PINS

End troublesome binding in parting dies.

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why the **Giddi**

gives

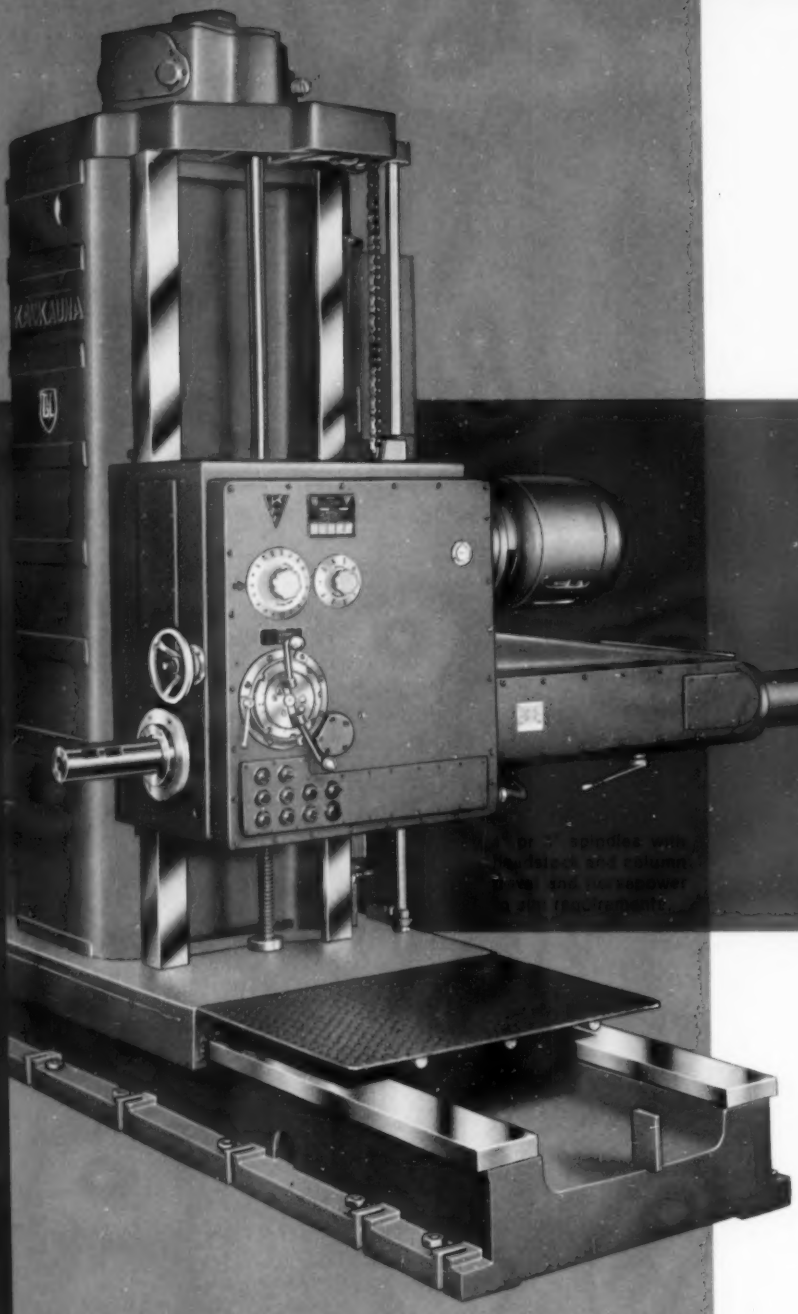
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Special machine performance

at a standard machine price

Only Giddings & Le

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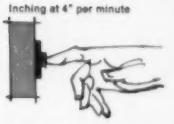
ddings & Lewis *horizontal*

ves you jig-bore accuracy in less than "jig time"!

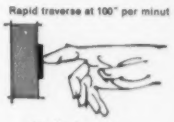
andard pushbutton controls speed positioning



You save time and reduce fatigue even on standard Giddings & Lewis horizontal boring machines because all controls are electric. There are no handwheels to obtain position. Operation is faster, and more accurate . . . clamping is automatic. Single pushbutton provides both inching and rapid traverse for horizontal and vertical movements. Feeds and speeds are preselected while the tool is cutting. To change them, the operator just hits the button when the new speed or feed is required. A variety of optional controls, including pendant or remote stations, is added easily and economically to a basic machine.



One-half depth



Full depth

...test automatic controls for precision work

...al your dimensions direct from a blueprint

...-of-a-kind parts can be precision machined at low production-... cost—big savings can be made in jigs, and layout work ...n using Giddings & Lewis digital-dial control (right). The ...rator just turns the dials for correct vertical and horizontal ...ensions, then depresses the read-in button to transfer input ...to visual light numbers for checking. With actuation of the ...omatic traverse button, the machine positions itself accu...ly, taking the shortest path to the preselected position.

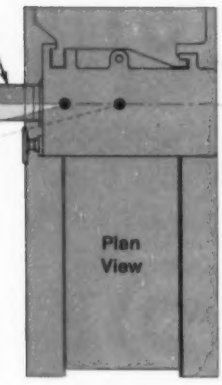




. . . or pace your production with tape!

Now, any operator can do jig-bore work in 30% less time. This simple, eight-channel, binary-code, punched-tape system—highly practical for any job-shop or production-shop operation—upgrades quality, increases production, and eliminates costly jigs and layout work. Tape operation can be interrupted at will to perform manual, milling, or digital-dial operations. System is completely divorced from machine wear, with no possibility of error accumulation. Zero offset provided for ease and simplicity of setup.

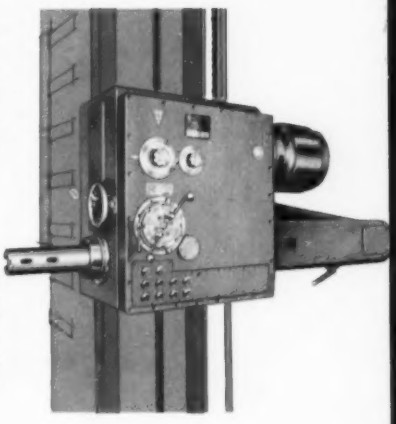
...clusive front-guide design reduces deflection at the spindle



Exclusive front-guide construction minimizes deflection errors when milling. The slightest movement cannot cock the spindle because head and column are guided on the front way, nearest the spindle—*under* the strongest weight-bearing surfaces of the runway.

Rigid box-type head takes more thrust

. . . more thrust than any other machine because the square-locked headstock has full-length gibbing on 4" ways. Box-shaped column and runway increase rigidity—not with "dead weight," but by scientific design that provides more capacity per pound.



...Lewis gives you ...ting features

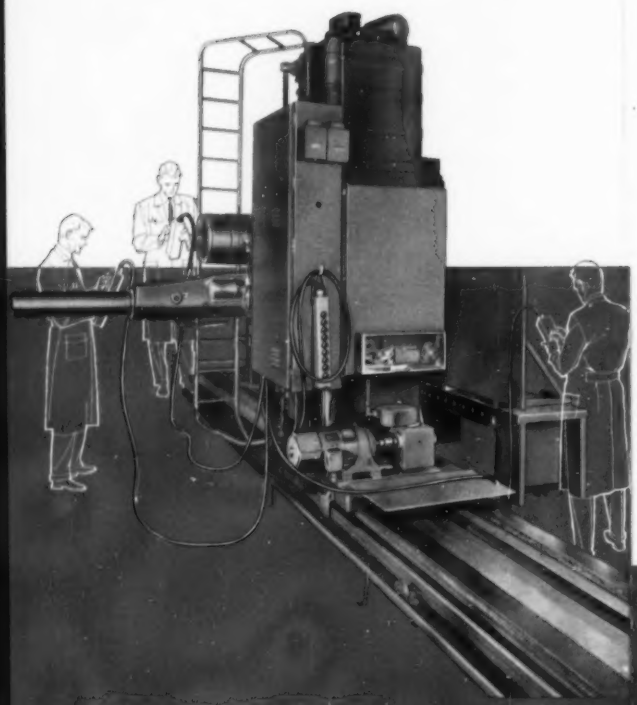
...• Automatic clamping and shift-...and head • Preselect speeds and ...ical control system • Electronic ...machine wear • Full-length gib-...trol systems • Straightest, most ...t strength per pound.

GIDDINGS & LEWIS

Kaukauna Machine Division / Giddings & Lewis Machine Tool Company

Kaukauna, Wisconsin

automatic control



New controls "hack" hidden costs on boring machines

Additional profits await job shops that will study hidden costs on boring machines. Tools valued at up to $250,000 are being used as "setup tables." Hours of nonproductive machine time are spent waiting for crane operators, setting up jigs and fixtures, or "jockeying" awkward machine controls to take relatively simple cuts. Other unnecessary costs include layout work and expensive jigs. Elimination of these costs is far more important than increasing cutting speeds. Giddings & Lewis machine controls described inside do just that!

to avoid unnecessary costs, make sure about these five features

nume

Tape-control ca competitive st

There will be fewer "st products because both cos ing and lead time are re tape. Production and meth hold the key to managemen uct and profit improveme

This Giddings & Lewis f horizontal boring, drilling, ing machine produced an in saving of 30% in direct costs Goss Printing Press Divisio Miehle-Dexter, Inc., Chic Handling and positioning machine parts are done mo setup is speeded; and both and accuracy are being pa

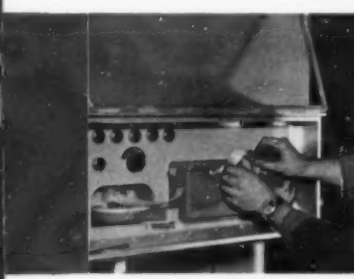


Fig. 1—*Operator loads tape* into re anism on back of column and turns Depressing "read-in" button on hea delivers first block of instructions

simple eight-channel, bin punched-tape system.

Even a 30% saving is owed by other economies w accrue. As Goss introduces chines or redesigns compon savings in jig costs will insu profit yield from the inve tape control. But the most benefit is this company's doctrination into a practic of automation for what mo would describe as a large "j operation. A big step has b towards the elimination of time and high costs which put the freeze on product ment and improvement. ment, engineering, and p men can now move faste competitive or technologic tunities.

nerical control NEWS

l capabilities will decide your standing in tomorrow's market

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Simple tape-control system with quick change-over to manual push-button or digital-dial input control.

The system used on this standard machine is characterized by simple positioning, simple control equipment, and simple machine instructions. Supervision includes all movements and clamping of the column and head plus tape selection of spindle speeds and feeds. For multiple repeat operations, there is automatic spindle cycle control—rapid approach, feed, and retract.

Depth of hole, hole size, and cutting tools are controlled by the operator from instructions provided in the typewritten manuscript. The manuscript is prepared simultaneously with the perforated control tape.

Average production shops have all the facilities needed to utilize such equipment fully without radical changes in methods. In fact, the tape-controlled machine at Goss is basically standard and can be operated selectively by tape, manual pushbutton, or digital-dial control.

Measures and repeats accurately

Vertical and horizontal positioning of the column and head are controlled by the electronic equivalent of a rack and pinion. The measuring system cannot be affected by temperature changes and no wear can occur between the controlling elements since there is no physical contact. It is completely divorced from the drive units so machine wear never shows up in positioning accuracy. Absolute measurement from an established but resettable zero point is done without accumulation of point-to-point errors.

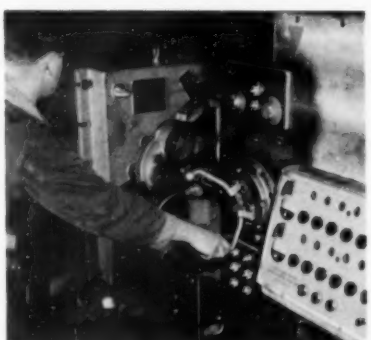


Fig. 2—*Digital-dial control* on headstock permits operator to dial head and column dimensions from blueprint into machine's electronic circuit.



Fig. 3—*Work mounted on rotary table* is indexed for boring opposite bearing journals using stub tooling. Alignment accuracy can be controlled without costly jigs.

Eliminates nonproductive work

The price of a tape-controlled machine tool is attractive because it includes all costs necessary to start work. Nonproductive operations such as template-making, scale and vernier reading, jig-making, and layout work are eliminated. Time and material loss from miscalculations, human error, and print-checking are minimized. There's no lost time in setting up work or handling heavy jigs.

Write for technical details

Opportunities in numerical control for both large and small shops are here. Keep informed by writing us or your Giddings & Lewis dealer for up-to-date technical literature.

GIDDINGS & LEWIS

Kaukauna Machine Division
Giddings & Lewis Machine Tool Company
Kaukauna, Wisconsin



A PRODUCT OF SKILL



BUTTERFIELD
100%
INSPECTED
TOOLS

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Butterfield drills, reamers, taps, dies, counterbores, cutters, end mills, hobs and carbide tools are craftsmanship-produced and are delivered rapidly anywhere. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **Call your Butterfield Distributor.**

BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

Now—FINISH FLAT

New Norton 6" x 18" Surface Grinder Ready For Immediate Delivery



You FINISH FLAT FASTER with the new Type S-3 hydraulic which is equally efficient for long production runs or a wide variety of toolroom grinding because of its new cost-cutting features. It produces plane surfaces smoothly — with automatic or manual cross feed and with such fast, cool-running action that it saves time and money on every job.

Ask your Norton Representative for the whole story. Or write us direct for Catalog 2128. And remember: only Norton Company offers you such long experience in both grinding machines and grinding wheels to bring the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

Profit from these benefits

1. Get Jobs Done Fast and Cool — high table speed, *125 feet per minute, maximum.* **2. Handle Tall Work Pieces** — greater vertical capacity, *15"*. **3. Get Lasting Accuracy** with guide-rail cross slide construction. **4. Control Vertical Feed Accurately and Position Fast** with two-speed .0001" increment hand wheel. **5. Benefit from Better Sighting and Loading** due to contoured splash guards. **6. True Forms, Even on Worn Wheels** because of recessed wheel spindle housing.

To Economize, Modernize with NEW

NORTON

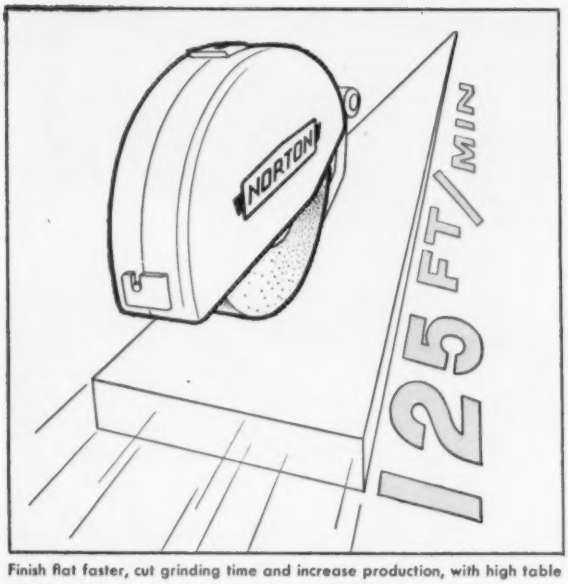
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Making better products... to make your products better

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FASTER.... at lower cost

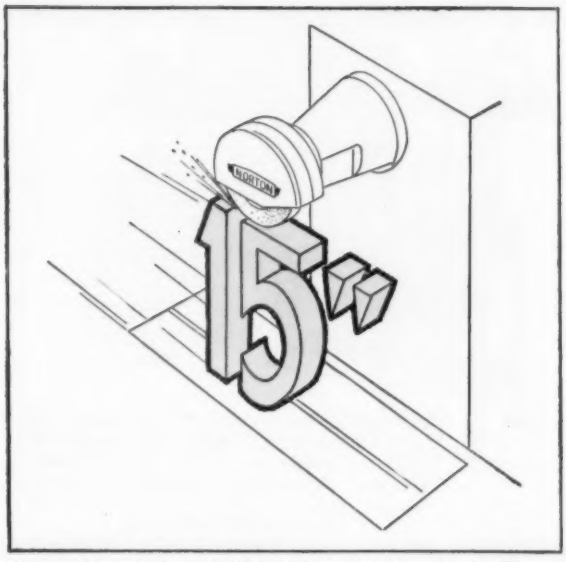
These and many other new features make this machine a "must" for your surface grinding jobs.



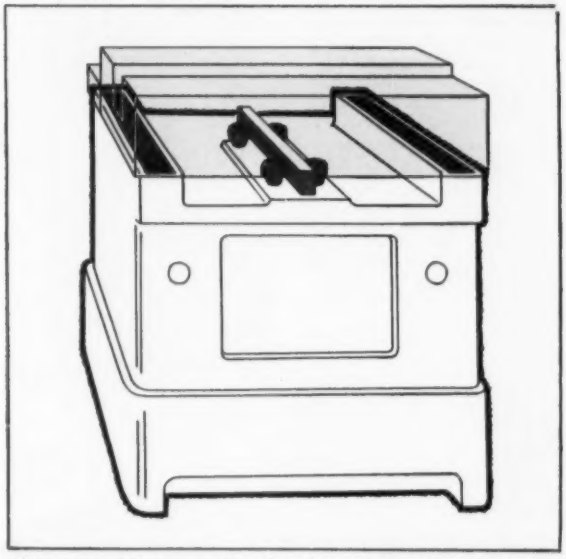
Finish flat faster, cut grinding time and increase production, with high table speed, 125 feet per minute.



Heat goes off in the chips, due to new, high table speed. This cooler grinding permits faster production on heat-sensitive metals.



Handle taller work pieces with high-grind wheel head construction. The vertical capacity from the table top to the bottom of standard full size 8" diameter grinding wheel is 15"



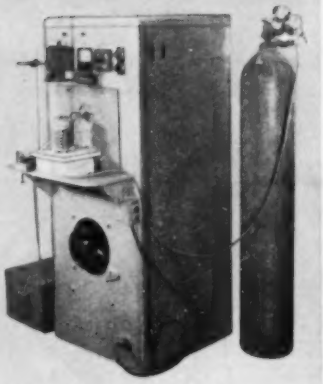
Widely spaced, flat ways and guide-rail cross slide design maintain cross feed accuracy, providing lastingly accurate grinding of shoulders or parallel surfaces.

A Complete Line of Lindberg



GTV-60 Vertical Tube Atmosphere Furnace: This furnace is ideal for numerous pilot plant or laboratory applications requiring protective atmosphere, cooling chamber and accurate stepless temperature control up to 2750° F.

Write for Bulletin T-1088



3 KW High Frequency Induction Unit: This unit has been designed for high frequency induction heating of both ferrous and non-ferrous materials, to any desired temperature up to 4200° F.

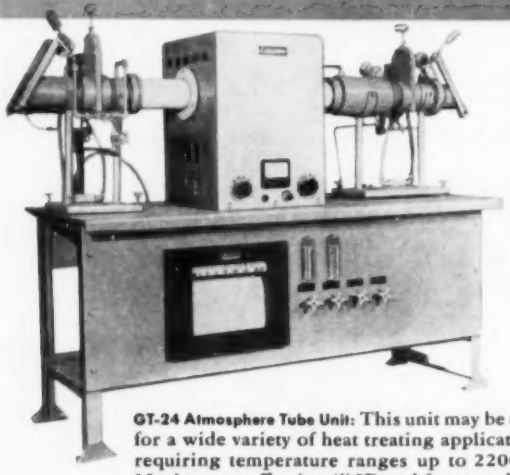
Write for Bulletin T-1093

Wherever heat is applied to industry there has long been need for economical experimentation beyond laboratory research and before actual production. Lindberg has now filled this need with this complete line of furnaces for pilot plant use. These furnaces provide, at moderate cost, means for developing techniques and methods for industrial heating applications under actual production standards ordinarily impossible to get with research laboratory equipment. Beyond this, they are generally usable for small



RB-45 Atmosphere Box Furnace: This rugged, compact furnace is designed for continuous operation at all heat levels up to 2000° F. It provides a clear working area 8" wide by 13" deep by 5" high.

Write for Bulletin T-1096



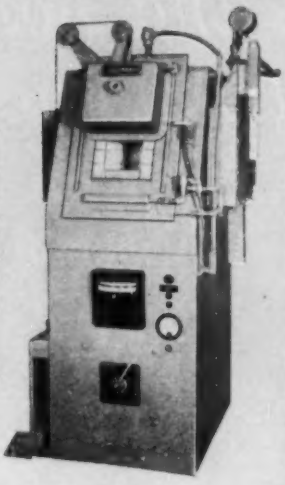
GT-24 Atmosphere Tube Unit: This unit may be used for a wide variety of heat treating applications requiring temperature ranges up to 2200° F. Maximum muffle size 4" ID and furnace chamber is 9" long.

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LINDBERG heat for industry

Furnaces for Pilot Plant Use



GB-30 Atmosphere Box Furnace: This general purpose heat treating furnace is designed for heavy and continuous duty at all heat levels up to 2500° F., but is capable of operation at 2700° F. for short or intermittent runs. It has a clear working area 6" wide by 12" deep by 5" high.

Write for Bulletin T-1087



RB-40 and RB-41 Box Furnaces: These non-atmosphere box furnaces provide precise temperature control up to 2000° F. Available in two chamber sizes: (RB-40) 4" by 4" by 10½", (RB-41) 5½" by 7½" by 14¼".

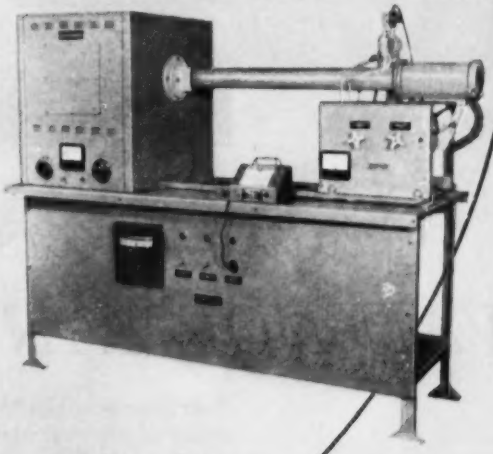
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production runs of small parts. Lindberg's long experience in the application of heat to industry has made possible the development of this useful pilot plant line. Lindberg's staff of engineers and technicians is also available to assist you in applying these furnaces, or any type of Lindberg equipment to your specific industrial heating problems. Consult your nearest Lindberg Field Representative (see your classified phone book) or write us direct for detailed information and descriptive bulletins.



GT-34 Atmosphere Tube Unit: This unit may be used for a wide variety of heat treating applications requiring temperature ranges up to 2750° F. Chamber 10" long, maximum tube size 4" ID. Available as floor or bench model.

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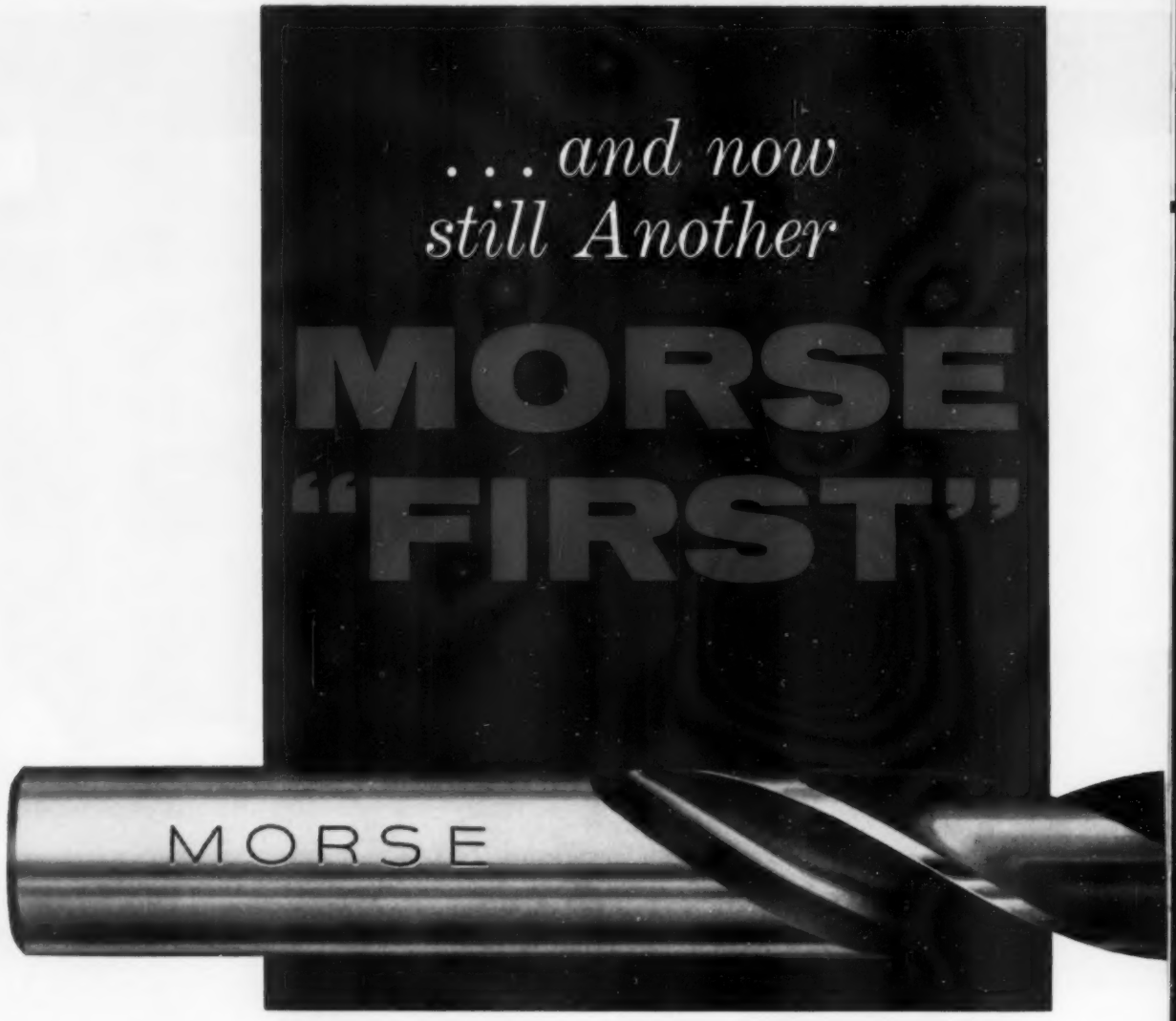


GT-25 Vacuum Retort Unit: This unit makes it possible to investigate vacuum metallurgy with a minimum investment. Provides temperatures up to 2150° F. with vacuum to 0.5 micron.

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Pilot Plant Equipment Division

LINDBERG ENGINEERING COMPANY 2447 West Hubbard Street, Chicago 12, Illinois



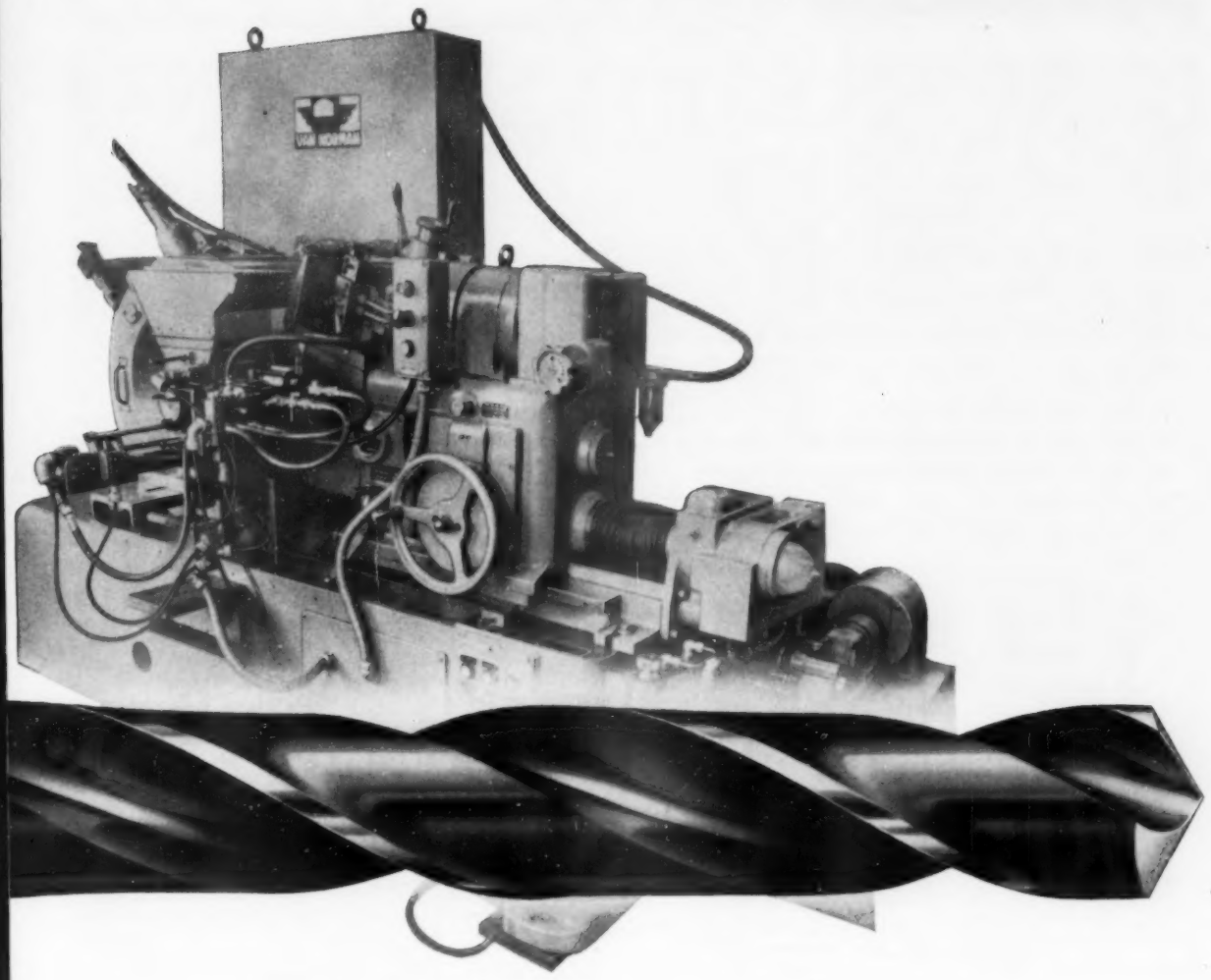
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Progress Report on Anocut Electrolytic Machining

For materials that are hard
. . . like carbides and hardened tool steels.

For materials that are tough and stringy, causing burring
. . . like stainless steel.

For materials that are heat sensitive, that tend to check, crack and lose important metallurgical properties in conventional grinding
. . . like die steels and aircraft super alloys.

Anocut anodic cutting (electrolytic and electrochemical machining are other names for the same thing) offers important advantages.

- Faster removal of many materials.
- No heat damage, checking or cracking.
- Fragile parts machined without burning, burring or distortion.
- Abrasive costs reduced 80%-90%.
- High tensile strength materials machined without burring.
- Laminated materials machined without smear or layover.
- Excellent finish.
- Accuracy of precision grinding.



A front interior view of **Model 300** showing placement of power components, fuse cut-outs, control chassis and relay panel.



Model 150, shown with control box for remote mounting.



Model 1500. For production work requiring as much as 1500 amperes.



Model 600. Model designation corresponds with ampere output capacity.

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Engineering Company
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Phone STate 2-5480

The Anocut electrolytic machining process, first introduced by Anocut three years ago, has not only proven itself in industrial service (over 50 per cent of all Anocut installations are the result of repeat orders for additional units) but the process has been vastly improved and broadened in application. Examples:

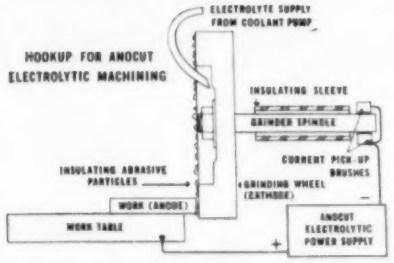
- Removal rate on steel cutting grades of carbide has been increased from **.030" per minute to .110" per minute** (½"x ½" slug).
- Hardened high speed steel can now be machined at **.360" per minute** (see opposite page) without burning or loss of temper.
- Form grinding wheels (non-diamond) are now available and can be dressed to form with a diamond point (see opposite page).

These results are not achieved by magic or wild claims of something for nothing but by conscientious adherence to the established principle that electrolytic metal removed is directly proportional to the electric current which can be passed through the electrolyte (conductive water base coolant) between the wheel and the work (Faraday's law). Continuing research on electrolytes, wheels and techniques of application has increased current carrying capacity and has resulted in tremendous progress in the three years since Anocut was introduced.

Leading machine tool manufacturers have given Anocut experienced friendly assistance, and now offer machines factory-made for Anocut electrolytic machining. Leading abrasive manufacturers have vastly improved metal bonded wheels, diamond and non-diamond, for Anocut electrolytic machining.

Anocut, whose sole business is the manufacture of electrolytic power supply units and electrolyte solutions and the engineering of applications for this potent new metal removal procedure stands ready to explore a broad range of machining problems which might benefit from its application. Anocut equipment will not be recommended except where it will prove of real advantage to the user.

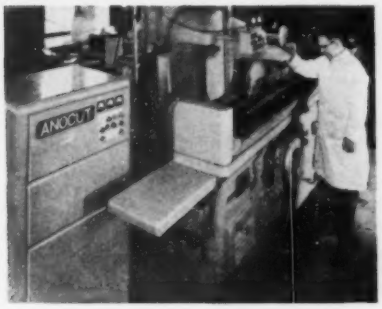
For further information call any of the leading manufacturers of machine tools (see list on opposite page). Fill out the coupon on the opposite page.



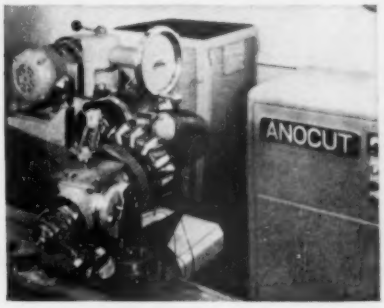
Electrolytic removal may be considered as the reverse of electroplating. The workpiece is made the anode in the circuit. The metal bonded abrasive grinding wheel is made the cathode. The two are spaced apart by the protrusion of abrasive particles (spacers) from the surface of the wheel. An electrolyte fluid flows across the surface of the wheel passing the current between the workpiece and the metal wheel. The automatically controlled direct current supplied by the Anocut unit causes the anode (workpiece) to dissolve as the abrasive particles of the wheel maintain size and finish. The amount of metal removal is directly proportional to the amount of current flow, in accordance with Faraday's law.

*The electrolytic grinding process, pioneered by Anocut, is covered by U.S. Patent No. 2,826,540. Others pending.

Some Good Applications for...
Anocut Electrolytic Machining



Thompson #3 Surface Grinder connected to Anocut Model 300 for grinding solid carbide inserts at Cooperative Carbide Grinding Co., Anderson, Indiana. Diamond wheel costs for this work have been reduced 90 per cent.



Gallmeyer & Livingston #60 Universal Grinder. Note brush assembly on work spindle. Face-type wheel is used with tooth plunged to depth. Once around and cutter is finished. Indexing time reduced by 90 per cent.



SCE-6 machine manufactured by Hammond Machinery Builders specifically for use with Anocut electrolytic equipment. See inset of ground tool. Entire installation paid out in six months.

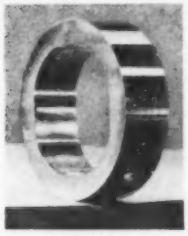


Fig. 1



Fig. 2

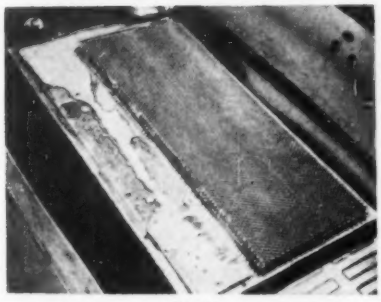


Fig. 3

Fig. 1—An example of grinding very hard tool steel. Internal cam form ground electrolytically, maintaining very tight tolerances and increasing production rate 300 per cent.

Fig. 2—Fir-tree form electrolytically ground in root of jet engine blade with non-diamond form wheel. Fifty blades (100 sides) ground with no loss of form. Speckled appearance results from exposure of crystal structure, visual proof of lack of abrasion or smear.

Fig. 3—Panel of stainless steel honeycomb, surfaced electrolytically. Surface must be burr-free for brazing to stainless steel sheet "skin." Thickness of ribbon is only .001 and any abrasion will cause layover and burr.

Fig. 4—A Detroit Gear Grinding machine was used for grinding this aircraft gear, using a formed non-diamond wheel. The complete gear (32 teeth) was ground without loss of tolerance, which is .0001". Approximately .004" removed from the flanks, .007" at the root in six seconds per tooth. Previous high rejection rate caused by checking, cracking and inaccuracy of form substantially reduced.

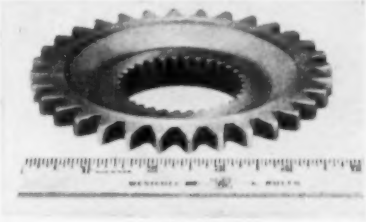


Fig. 4



Fig. 5

Fig. 5—End platforms covered with hardface material ground on this jet engine vane using split-wheel set-up on Gallmeyer & Livingston surface grinder with Anocut Model 600. Grinding time reduced from 188 seconds to 37 seconds, with problems of heat-checking eliminated



Fig. 6

Fig. 6—T-15 steel, hardened to 65 Rockwell C, 166 seconds to remove 1".

Most of the major machine tool builders now offer their equipment with the necessary insulation and spindle brushes to permit ready application to electrolytic machining. Among these are the following:

Abrasive Machine Tool Co.
The Blanchard Machine Co.
Besly-Welles Corporation
Brown & Sharpe Manufacturing Co.
Cincinnati Milling & Grinding Machines, Inc.
Covel Manufacturing Co.
DeVlieg Machine Co.
Ex-Cell-O Corporation
Frauenthal Division
Gallmeyer & Livingston Co.
Gardner Machine Company
Hammond Machinery Builders, Inc.
Mattison Machine Works
Norton Company
Onsrud Machine Works
Pope Machinery Corporation
Reid Brothers Co., Inc.
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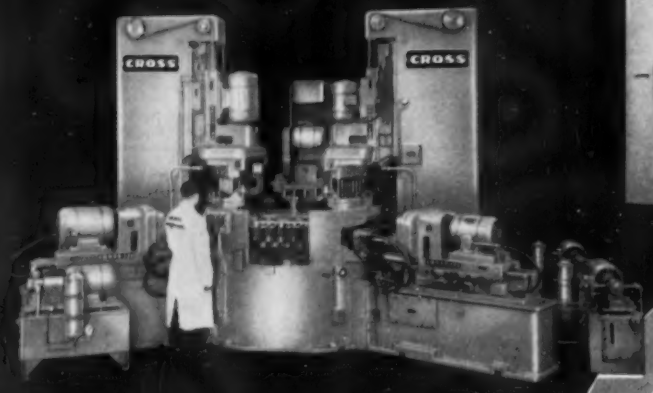
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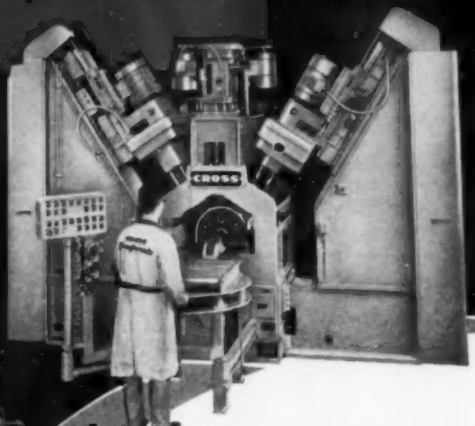
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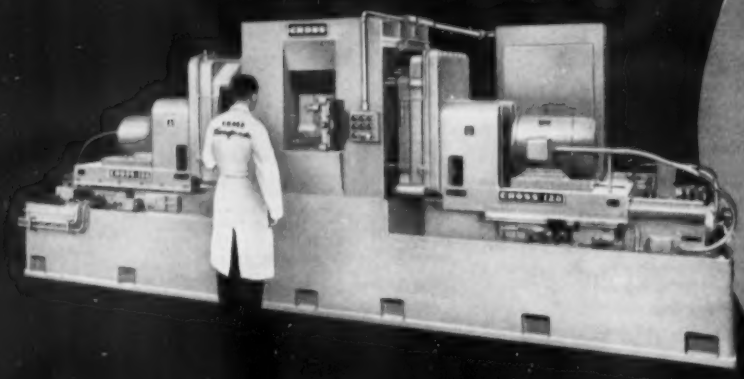
6 ways to automate

Cross automation takes many forms . . . from the simplest low production machines to complex equipment for mass production.





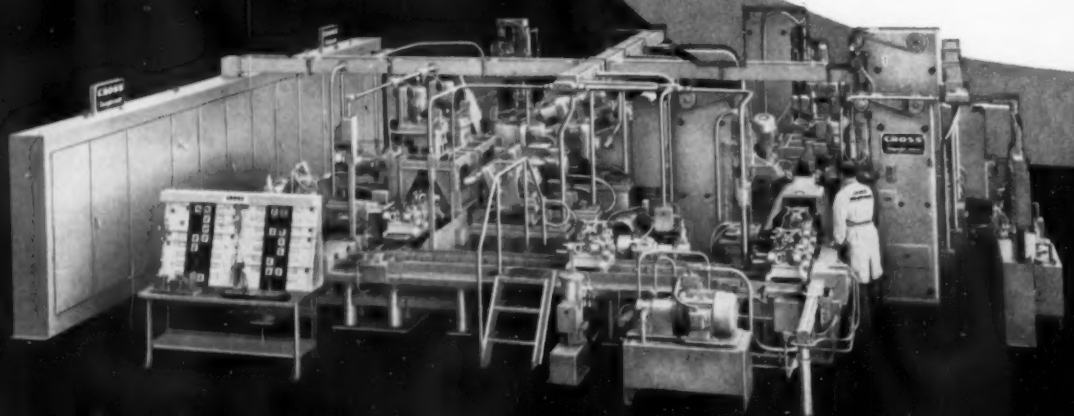
1 **CROSS SINGLE STATION MACHINES** exist in many configurations to combine operations.

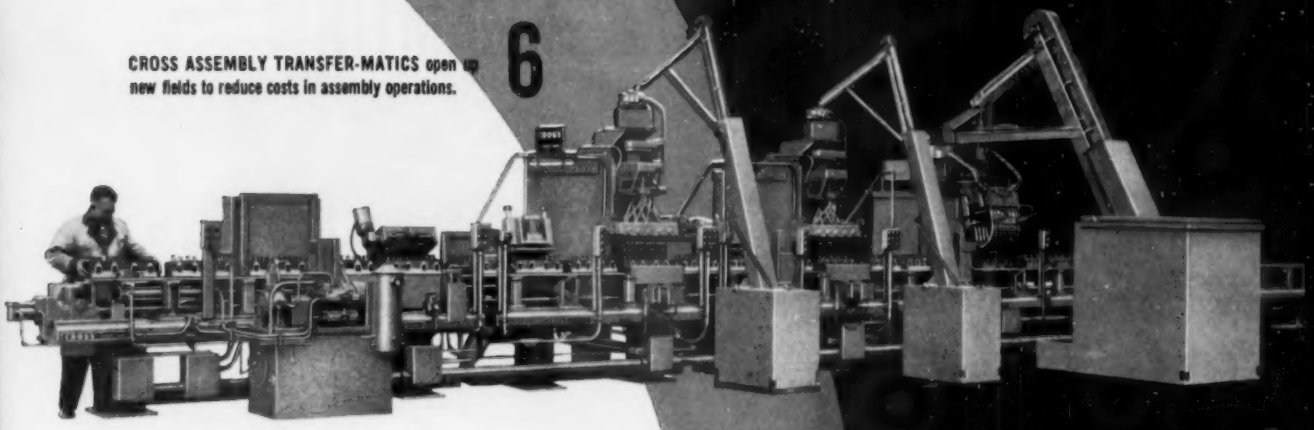


2 **CROSS DIAL TYPE MACHINES** provide multiple station performance with minimum floor space.

3 **CROSS TRUNNION TYPE MACHINES** are compact multiple station units that permit operations on opposite sides of the part.

4 **CROSS PALLET TYPE TRANSFER-MATICS** provide capacity for combining a large number of operations. Standard pallet fixtures handle irregularly shaped parts with maximum flexibility.



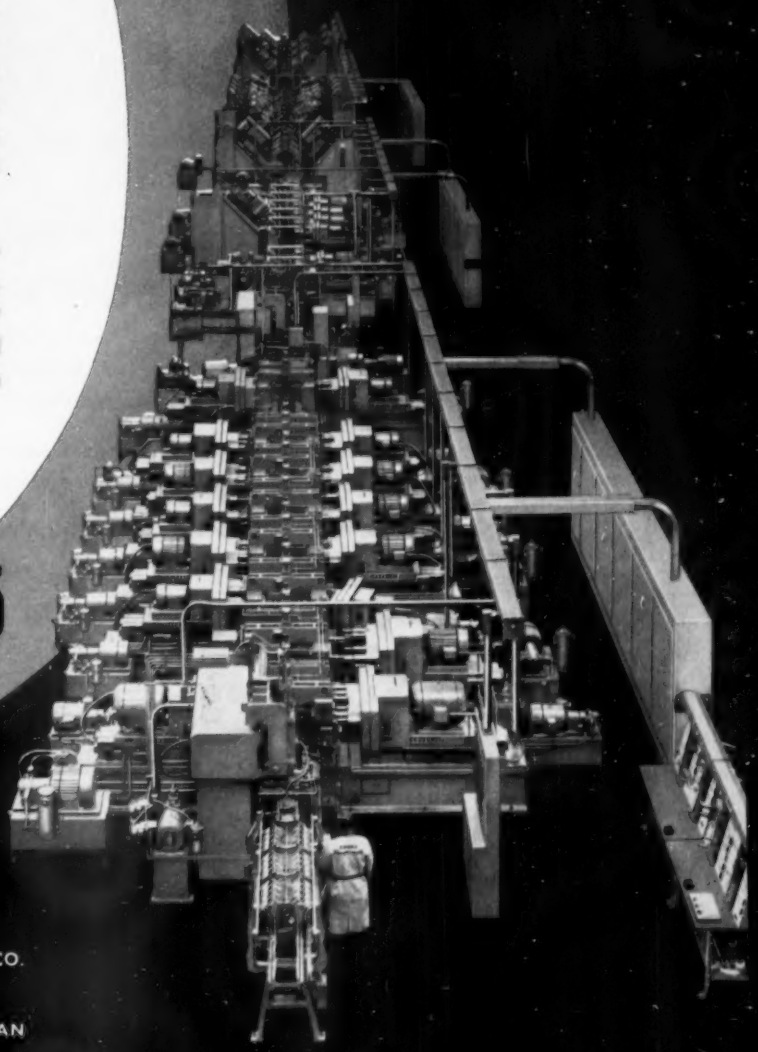


CROSS ASSEMBLY TRANSFER-MATICS open up new fields to reduce costs in assembly operations. **6**

The six machine types illustrated here were created by Cross to apply the principles of automation to a wide variety of metalworking operations. Thus, Cross makes available the benefits of automation to small or large manufacturers, regardless of required production volume.

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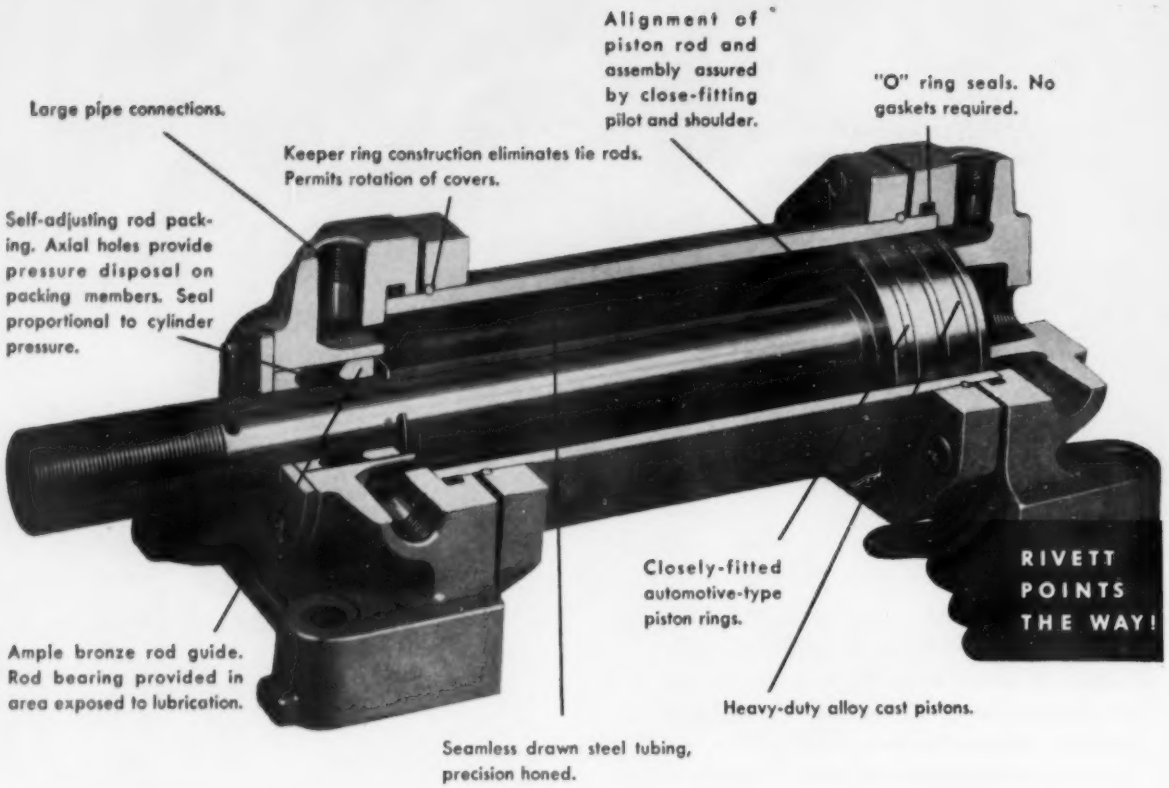


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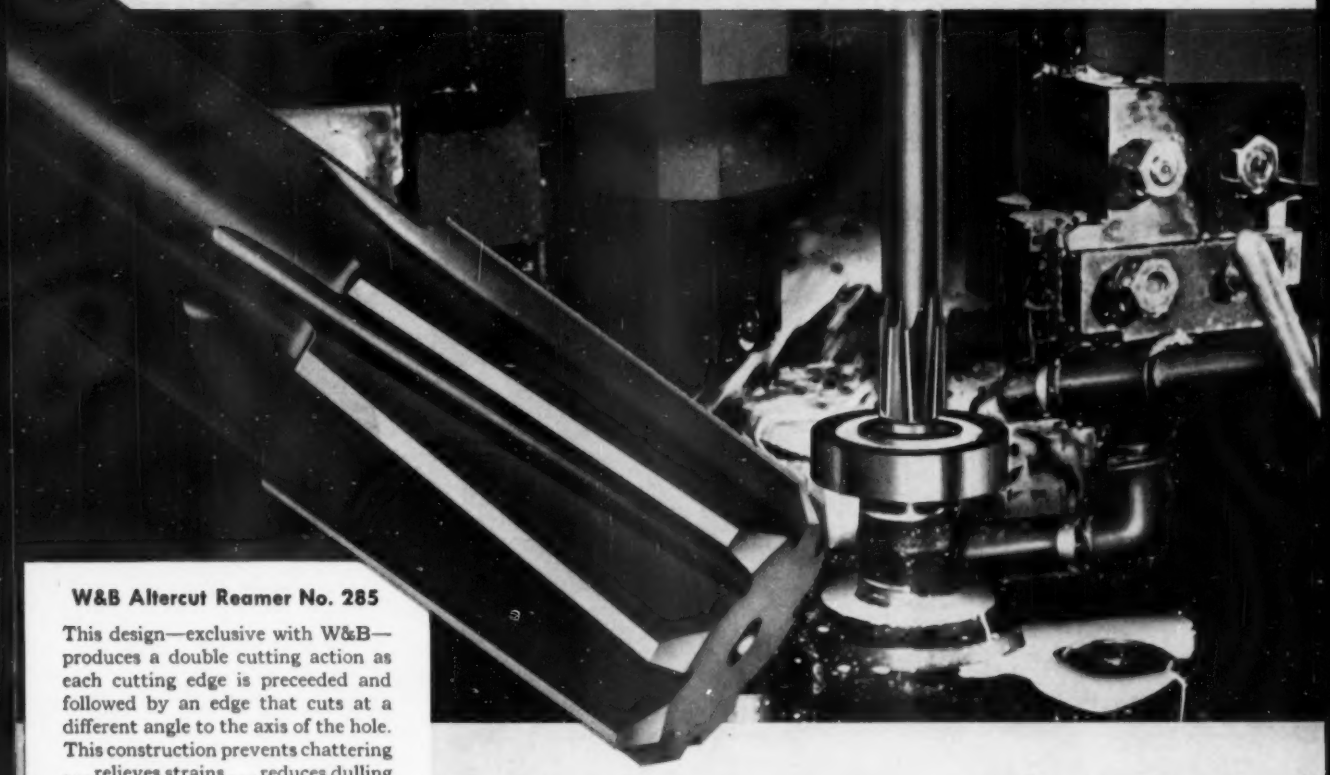
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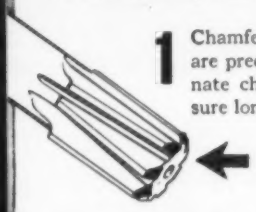
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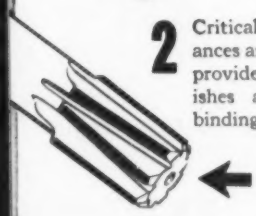


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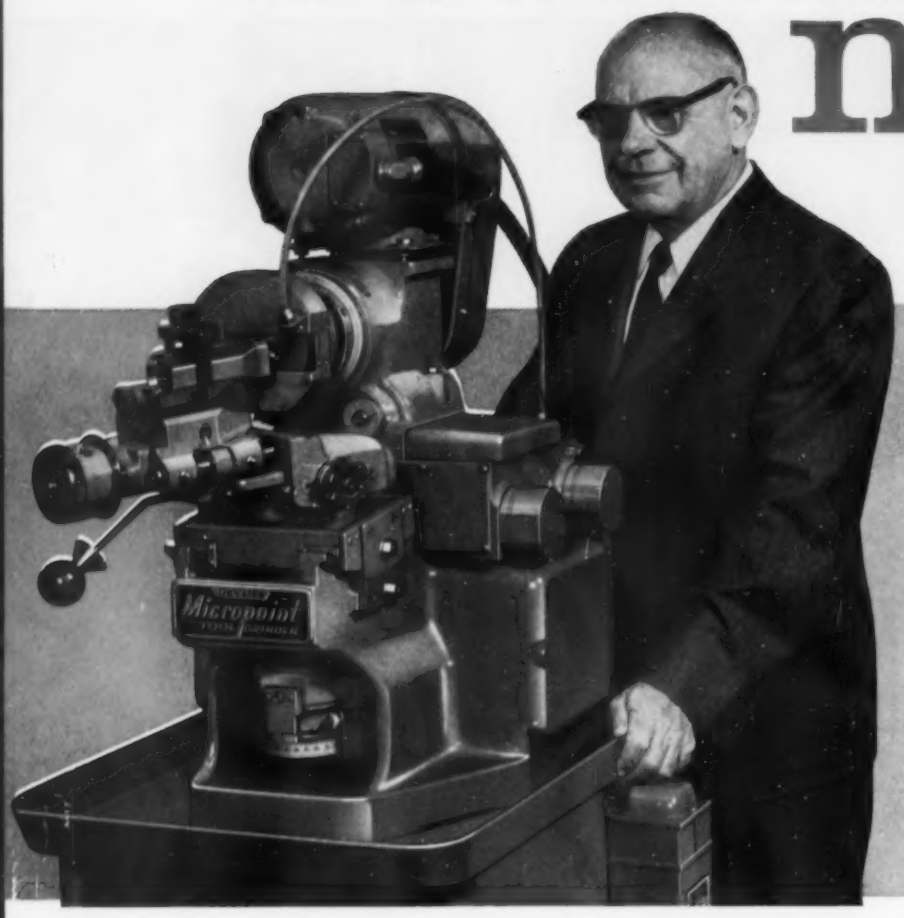
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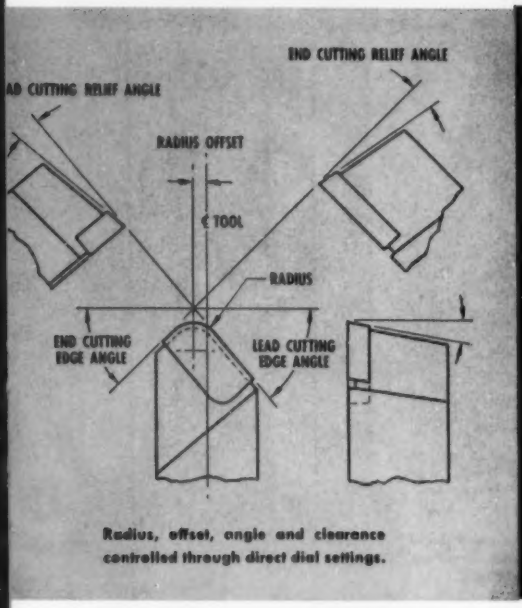
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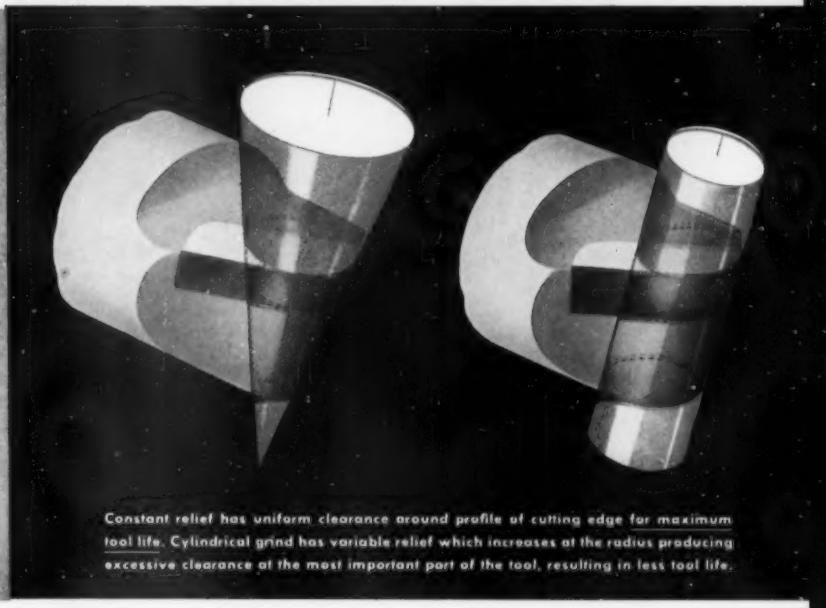
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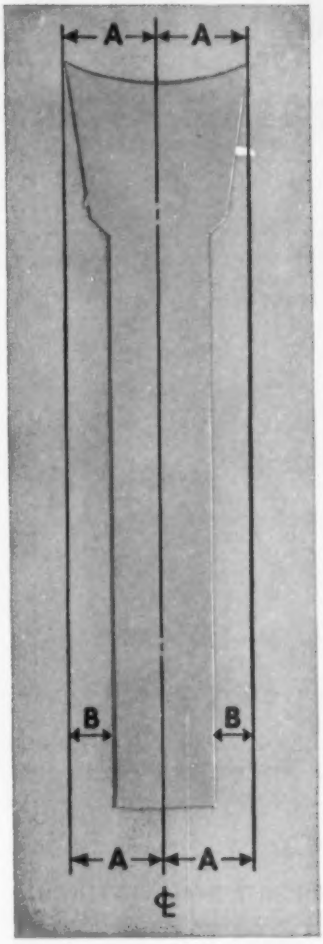
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515 South Wolf Road • Des Plaines, Illinois

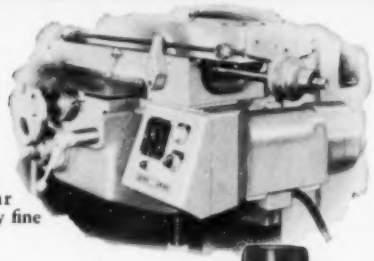
A DIVISION OF PARKER-HANNIFIN CORPORATION

Eventually you'll buy a GORTON MASTERMIL

here's why

DYNA-DRIVE
"The Torque-Thinking" Table Feed

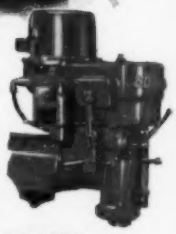
"Feels as it feeds"... automatically adjusts for exact amount of torque required. "Thinks while it works", compensates electronically for variations in density, hardness, molecular structure of materials. Result: Superbly fine finish, longer cutter life.





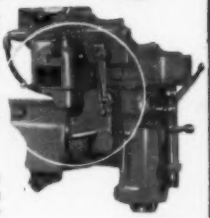
SWIVEL HEAD

2 HP dynamically balanced motor with belt and gear train provides wide range of speeds from 80 RPM to 5,600 RPM. Head swivels 90° left or right, head, ram and turret rotate 180°. Cross movement 14 inches. Push button starting.



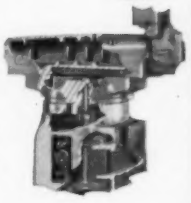
DOWN FEED INFINITELY VARIABLE

Feeds may be varied infinitely from 0" to 5" independent of spindle speeds. High efficiency belt drive. Direction and rate of feed separately controlled.



PERMANENT ACCURACY BUILT-IN

Distortion is prevented by extra heavy one-piece column cast with over-size ribbing . . . extra heavy alloy steel turret clamping bolt (1⅜" dia) with 3-point clamping action . . . heavy dovetail way full length of vertical column face . . . extra large table, knee and 24" saddle (2" longer than table travel) . . . square lock bearings with long, narrow guide between knee and saddle . . . positive locks . . . extra heavy feed screws . . . bearing surfaces hand-scraped.



© 1958 George Gorton Machine Co.

Complete Versatility Through Attachments Built-In or Field Installed.

Among such equipment is, Trace-Master Hydraulic Tracer Control, Duplicator Tracer Head and/or Table with base, saddle and table in one unit, 6" Raising Block, End Measuring Rods and Dial Indicators, Self-Contained Coolant System.

Write for Bulletin 2699-2602



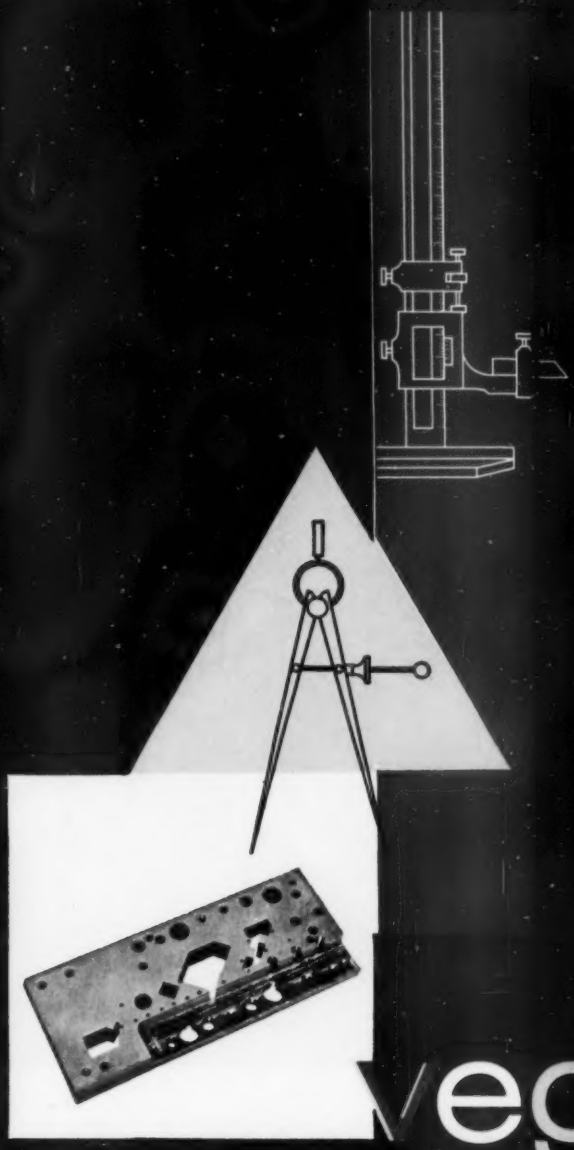
GORTON

GEORGE GORTON MACHINE CO.

2602 Racine Street • Racine, Wisconsin

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.



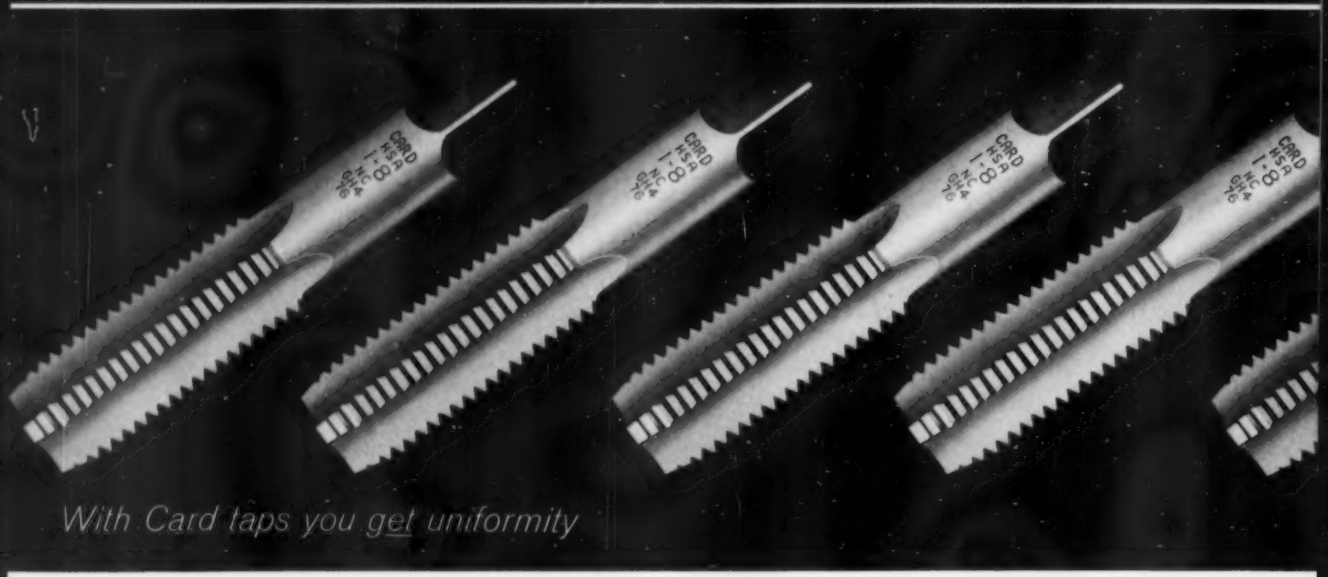
Vega

air-hardening tool and die steel offers safety in hardening unmatched in the industry. Even intricate dies with many cutouts, sharp corners and thin sections come through heat treatment with outstanding freedom from warpage and size change. VEGA is a tough steel specially developed by Carpenter to combine the machining properties of an oil-hardening grade with the safety in hardening of an air-hardening steel. On job after job, VEGA has outperformed any other grade ever tried! Order today from your nearby Carpenter SERVICE-CENTER.

the *Carpenter* Steel Company, Reading, Pa.



When you see uniformity, remember...



With Card taps you get uniformity

Your production's consistent ...because Card taps are uniform

Keeping production up to par calls for cutting tools that perform correctly whenever used — and are exactly alike, whenever reordered. You're sure of these advantages with Card taps, because each is identical with every other of the same type and size. Shopmen everywhere know this—have been shown by Card technical men how the uniformity of Card taps and gages is predictable and profitable. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

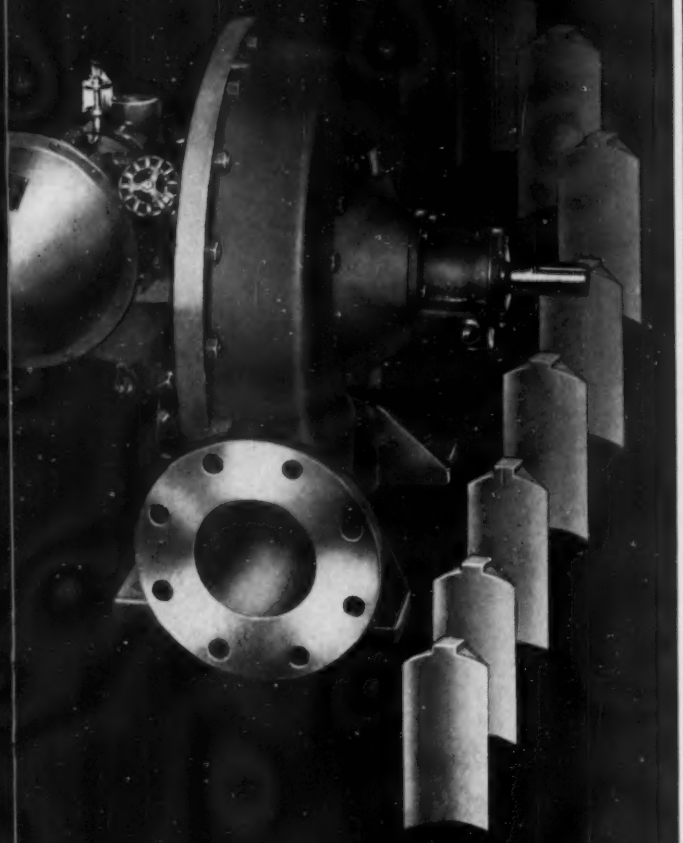


CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through the best distributors from Coast to Coast

If you use end mills the way turbines use blades . . .



Ordering Union end mills will cut your production time and costs



The more you use end mills the more you need Union

Choosing from the broad variety of Union end mills, you'll find the new center cutting types ideal for plunge cutting and pocketing cuts. Made with 4 flutes, they mill in any direction with speed and economy, and provide extra fine finishing. In plants throughout the country Union technical men have proved that the time and costs of many production operations can be reduced with Union end mills, drills, milling cutters, gear cutters, reamers, hobs, carbide tools and inserted blade cutters. **Available nationally through Union Distributors** and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

UTD

UNION

TWIST DRILL COMPANY, Athol, Massachusetts

S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

DOW | MAGNESIUM



HERE'S REAL FLATNESS! *Dow magnesium tooling plate flatness is measured as the maximum deviation under a straightedge.*

NEW! CLOSER FLATNESS TOLERANCES IN DOW MAGNESIUM TOOLING PLATE

PRECISION PLUS. Now you can buy this lightweight tooling metal with closer flatness tolerances than ever before. With new production methods Dow magnesium tooling plate is now manufactured to these tolerances:

	In any one foot		In any 6 feet	
THICKNESS	GUARANTEED	TYPICAL	GUARANTEED	TYPICAL
0.250"-1.000"	0.005	0.003	0.015	0.007
1.001"-6.000"	0.010	0.005	0.020	0.010

COSTS NO MORE. This big improvement in quality and value costs you not one penny more! Dow magnesium tooling plate STILL costs less than other lightweight tooling metals. You save money twice—once when you buy it and again when you use it.

Magnesium tooling plate is low in cost because it is rolled (not machined) to a flatness satisfactory for virtually all tooling purposes.

Next time you need a tooling metal, get in touch with one of the Dow magnesium suppliers listed below. A trial will convince you it pays to switch to magnesium. THE DOW CHEMICAL COMPANY, Magnesium Sales Department, Midland, Michigan, 1334FJ2.

AVAILABLE FROM STOCK AT:

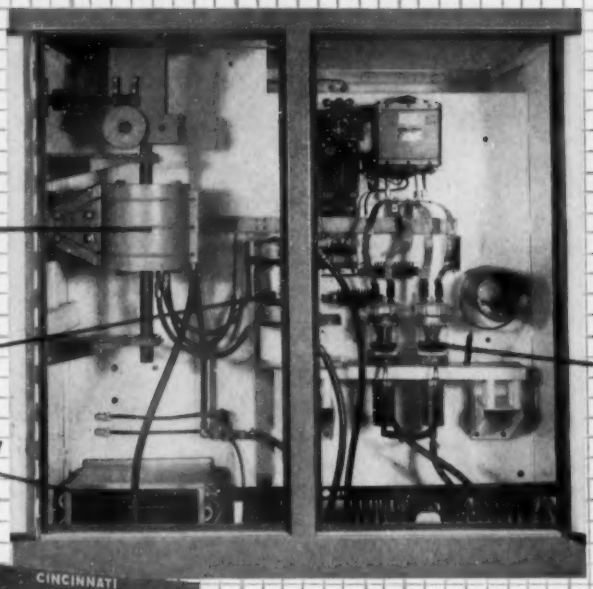
COPPER AND BRASS SALES, Detroit 12, Michigan
FULLERTON STEEL AND WIRE CO., Chicago, Illinois
HUBBELL METALS INC., St. Louis 3, Missouri
A. R. PURDY CO., INC., Lyndhurst, New Jersey
RELIANCE MAGNESIUM COMPANY, Los Angeles, California
VINSON STEEL AND ALUMINUM COMPANY, Dallas, Texas

A dividing wall separates the oscillator section (shown at right), from the power supply section (shown below). Door interlock switches are used on all access panels. All components are readily accessible and arranged for easy maintenance.

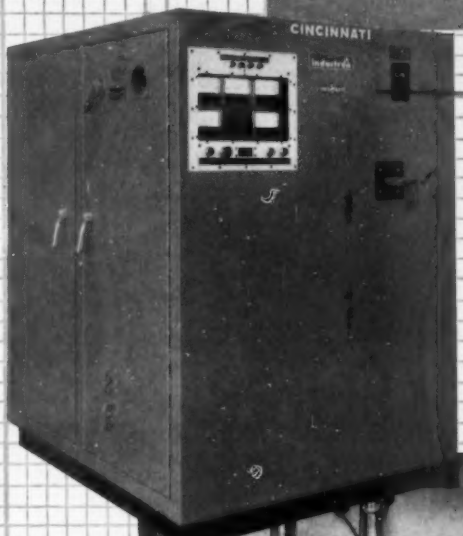
With this variable output RF transformer, output can be varied under load from 30% to 100% rating by positioning one dial.

Simplified, high KVA rated tank circuit includes vacuum capacitors for lowest possible power loss.

Cabinet air is cooled by water heat exchanger and blower. Air and water temperatures are thermostat controlled.



New type, extra-rugged duty low Mu oscillator tubes are especially designed for rugged industrial use. Filament supply to these tubes are both voltage regulated at ± 1% of nominal and ± 3% over a 27% line supply variation, and current limited to 200% inrush. Rectifier filaments also receive the same regulated supply. This insures longest tube life.



Here is the 30KW Cincinnati Inductron - operates at frequencies of approx. 1200KC. Also built in 15KW and 50KW capacities. A compact, self-contained, one cabinet unit.

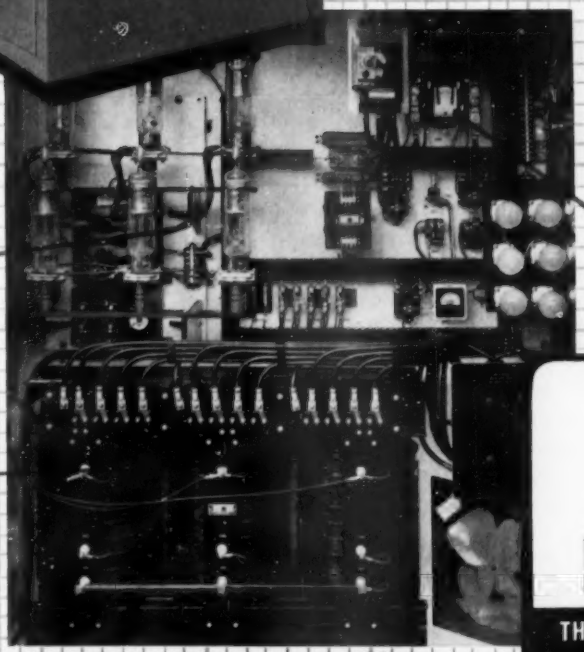
Important Note to Users of Induction Heating Equipment

The CINCINNATI INDUCTRON has the design that provides for highest operating efficiency - maximum component life - easiest, lowest-cost maintenance. Check these features-

All controls are panel mounted, providing easy access for inspection and maintenance. Controls provide a more complete cross-section indication of the operation of the circuit than any other induction heater in the field.

Three phase, full wave bridge rectifier circuit uses industrial-type, heavy duty mercury vapor rectifier tubes. Tubes are arranged for even, forced air cooling.

Complete encapsulation against moisture and dirt, plus pie-type secondary windings, and even, forced air cooling insure long life for the plate supply transformer.



inductron
flamatic
hardening machines

META-DYNAMICS DIVISION
Machines for Metal Forming and Heat Treating

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

CINCINNATI

For detailed information, call in a Meta-Dynamics Division field engineer.

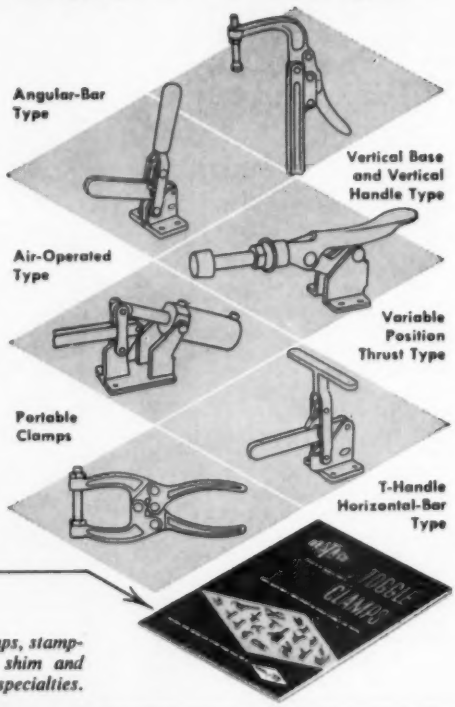


Where It's Quality, Quality, Quality! It's Quality DE-STA-CO Toggle Clamps

FINAL INSPECTION OF ROSS OPERATING VALVES subjects every valve to a pressure test far exceeding its normal usage. For over fifteen years, fixtures similar to this, all employing De-Sta-Co No. 620 plunger clamps, have been built to do this critical high pressure sealing job.

Whether your holding and clamping operation is inspection, machining, tapping, grinding, welding, bonding or other assembly, there is a specific De-Sta-Co Toggle Clamp to do it better. Fast action, positive clamping, long life through thousands of production operations have made De-Sta-Co known for almost 30 years as the leading tool in the field. And all of our medium and larger models use hardened serrated pins in hardened bushings staked to prevent wear. A broad selection of spindle accessories increases the versatility of the clamp you specify.

Our representative in your area is qualified and ready to serve you. Send for our catalog showing clamp applications, scale drawings and complete information.



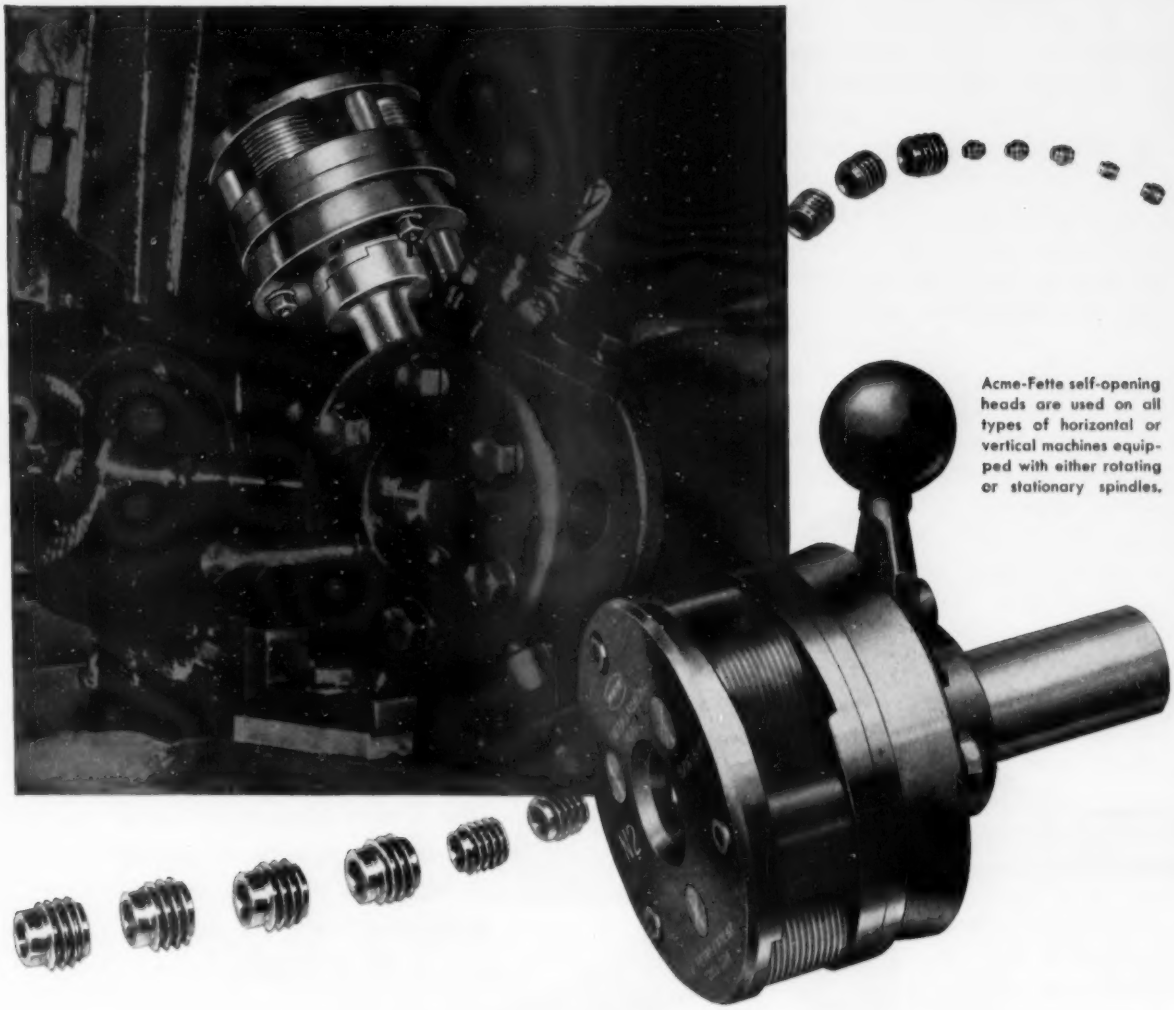
DE-STA-CO

ORIGINATORS OF PRODUCTION CLAMPING

De-Sta-Co is widely known for toggle clamps, stampings, precision washers, spacers, shims, shim and feeler stock, blower housings and marine specialties.

DETROIT STAMPING COMPANY

328 MIDLAND AVENUE • DETROIT 3, MICHIGAN



Acme-Fette self-opening heads are used on all types of horizontal or vertical machines equipped with either rotating or stationary spindles.

Fasteners, Inc. completely eliminates crest cratering and seaming

...with ACME-FETTE Thread Rolling Heads

"Superior to any other method," say the customers of this Pittsfield, Massachusetts manufacturer of Kelox® threaded inserts. That's why they have profitably installed Acme-Fette thread rolling heads on *existing* turning equipment.

These precision heads generate the threads *ahead* of the rolls. This causes metal to flow to the full depth of the thread and eliminates broken grain structure and cratering at thread crest. The result is threads with a high grade burnished surface, remarkably resistant to abrasion, wear and corrosion.

Acme-Fette heads roll all parallel thread forms from 1/16" to 2" at speeds equal to turning speeds with high speed steel tools . . . up to 5 times faster than conventional thread cutting. For cost-reducing ideas showing how you can put Acme-Fette heads to work on your *present* equipment, send for Bulletin NAF-57A.

National Acme

The National Acme Company
193 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.



The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.

You can produce greater savings than you can buy

The economic truth of the above statement applies to all manufacturing and is especially true in grinding wheels.

There are less expensive grinding wheels than Norton wheels — and on the invoice they may look like a bargain. But if the wheels purchased fail to perform efficiently on the production line or incur production delays because of poor quality or misapplication — a higher cost of production is the price actually paid.

In brief, *the true measure of grinding wheel value is not how much you paid for it — but how much you get from it. Here is what you can get from Norton* —

Norton Company gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field — and you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of 1 year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years abrasive experience in addition to the specialized training. He is the most knowledgeable man in abrasives that you can consult. He is your consulting abrasive engineer.

He will make a free Abrasive Requirement Study for you. This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems.

For example, your Norton Man can increase production by pointing out ways to better wheel usage and fewer wheel changes. He has the widest selection of grinding wheels in the industry to help him select the perfect wheel for new product grinding operations and improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

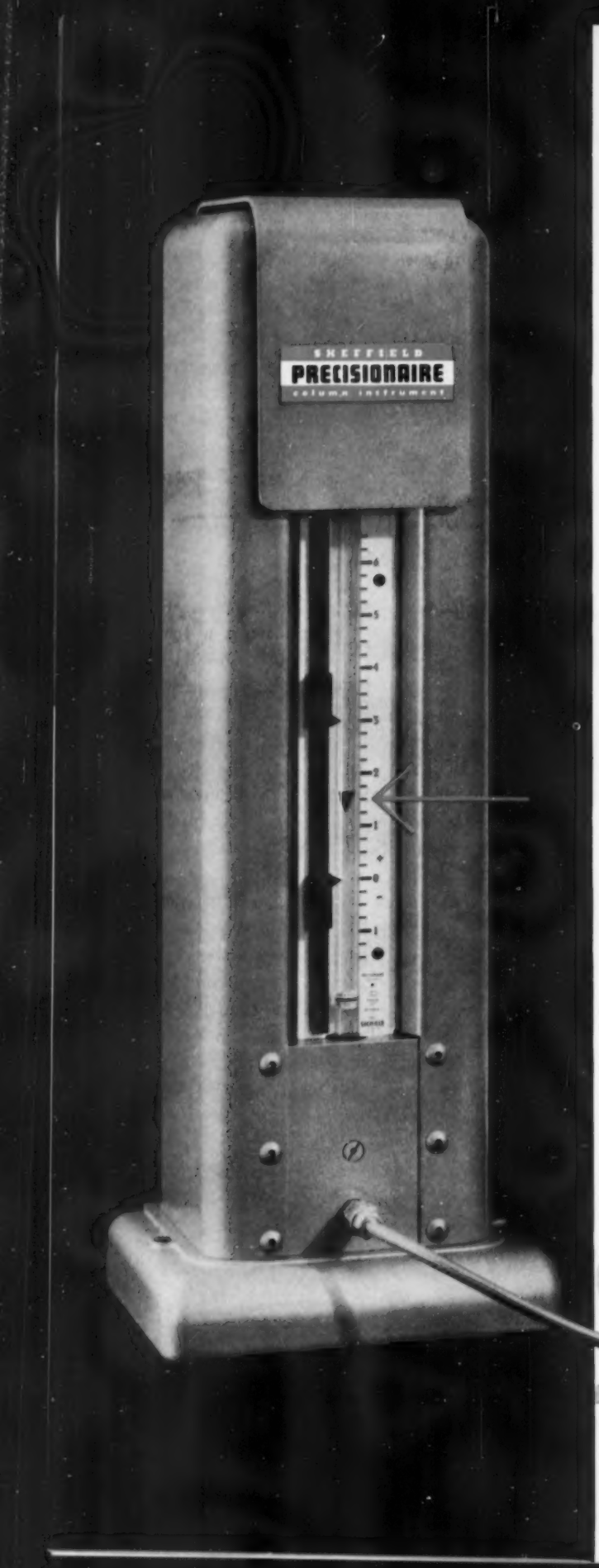
Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

W-1891

NORTON

ABRASIVES

MAKING BETTER PRODUCTS TO MAKE YOUR PRODUCTS BETTER



THE ONLY MOVING PART FLOATS ON AIR

Precisionaire®: the gage that always works.

The Sheffield Precisionaire® gage is the most accurate, most dependable, most widely accepted air gage money can buy. Here's proof:

There are more Precisionaires in use than all other air gages combined.

Of the nation's 500 largest companies, every one engaged in precision manufacturing uses Sheffield. Only Sheffield offers these advantages:

Precision built into instrument

Amplification and linearity are built into the glass float tube permanently—immune to "hidden drift" and misadjustment. Amplification is entirely pneumatic, linear over the full 8" scale, even for dimensions smaller than .185". Scale is the longest available anywhere. A Precisionaire is ready to go without warm-up.

Choose and change amplification

Only Sheffield lets you select the amplification you need from 50:1 through 100,000:1 or greater. When your requirements change, you convert to another standard amplification in 2 minutes with an inexpensive kit. A Precisionaire stays new.

Maintenance-free—always

The only moving part—the float—is suspended in a column of filtered air. This illustrates the design simplicity, inherent proof that a Precisionaire never wears out. You can depend on accurate, repeatable dimensional readings day-after-day, year-after-year no matter how often your requirements change.

Choose gaging elements you need

Only from Sheffield can you select the **exact** size sensing element you need from the broadest inventoried line available. Your complete Sheffield gaging system carries a single nameplate guarantee and is backed by a coast-to-coast network of gaging centers.

Unskilled people read it faster

Simple two-master setting is **always** reliable and is the only **proven** way to compensate for every operating variable. Tolerance display is as great as desired. Bold, clear markings read directly in fractions of an inch, without parallax. Gage response is virtually instantaneous even when the part is remotely located. You check multiple dimensions with one quick eye-sweep over compactly grouped columns. Computing circuits eliminate "figuring" on complex multiple checking.

Sheffield knows air gaging

During 18 years of leadership, Sheffield has simplified, refined and polished air gage design for maximum accuracy and reliability. A reason you can depend on Sheffield recommendations is that Sheffield makes **every** type of dimensional indicating gage—pneumatic, electronic, electric and optical-mechanical. Your needs **alone** form the basis of a proposal.

Write for catalog

Find out now about the dollar advantages of Sheffield air gaging systems. Contact your Sheffield gage engineer through your Yellow Pages, or write direct for Catalog No. AGS-1-59

THE SHEFFIELD CORPORATION
Dayton 1, Ohio, U.S.A. CL 4-5377



the **SHEFFIELD** *corporation*
of Bendix Aviation
manufacture and measurement for mankind



New "Comapro" project cuts machining time up to 30%...

GULF MAKES THINGS

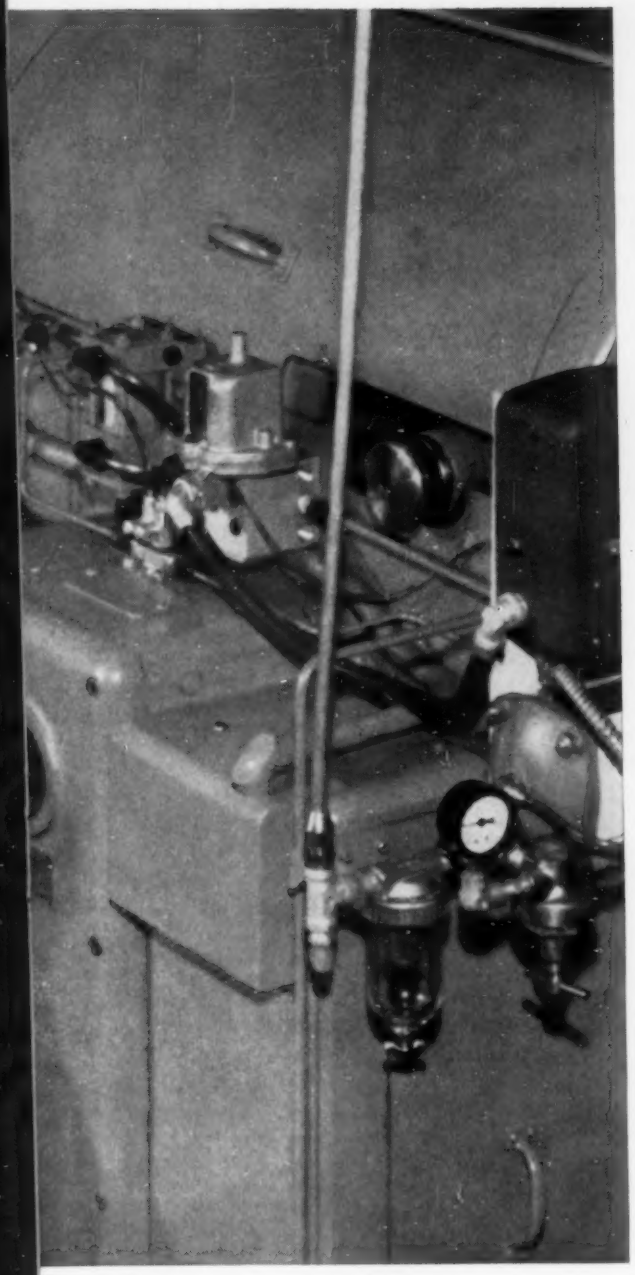
Only five months under way, the Cooperative Machining Project known as "Comapro" has already developed unusual time-saving and cost-cutting machining practices, using Gulfcut Cutting Oils.

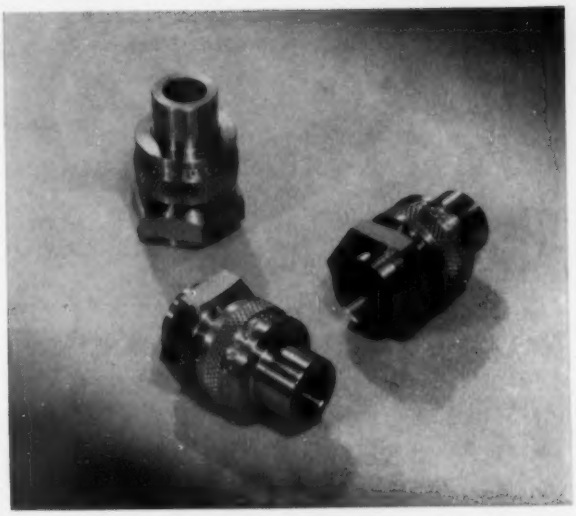
A case in point is the machining of a simulated spark plug shell at the COMAPRO Department of one of the participating manufacturers—Cone Automatic Machine Company, Windsor, Vermont.

Using Gulfcut Cutting Oil in a Conomatic bar machine, they're running this spark plug part in 4.4 seconds, compared to an industry average of 6 seconds. A 30% saving in machining time!

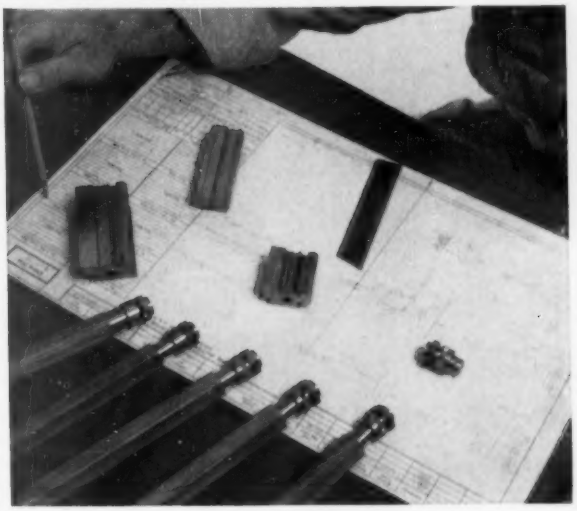
This is right in line with the over-all objective of "Comapro"—to develop more efficient ways to cut the cost-per-part figures in a wide variety of machining jobs, particularly in mass production. Findings will be made available to the entire metalworking industry.

As a co-sponsor of "Comapro," Gulf supplies all the





Lower cost per piece—on a great variety of machined parts—is the main goal of the "Comapro" cooperative cost-research program. For complete information on the latest findings of the project, write to COMAPRO, c/o Cone Automatic Machine Company, Windsor, Vermont.



This Conomatic automatic bar machine is a pilot unit in the "Comapro" research project. Gulfcut Heavy Duty Soluble Oil helps it operate at maximum output, to determine best machining practice at lowest cost per part.

and proves again

RUN BETTER!

cutting oils for the project, from the complete Gulfcut line—plus Gulf greases and machine lubricants. Under closely controlled research conditions, the proof is piling up that Gulf makes things run better!

Let us help you put "Comapro" findings to work in *your* production—and show you how Gulf makes things run better in your plant, operation-wise and cost-wise. For complete information, call a Gulf Sales Engineer at the nearest Gulf office.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pennsylvania

GULF

NEW



MILFORD

SAW & BAND SAW BLADES • HACK • HOLE SAWS • GROUND FLAT STOCK • SEGS

THE HENRY G. THOMPSON & SON CO., New Haven 5, Connecticut

Saw Blade Specialists for Over 80 Years

MILBAND
BAND SAW
MACHINE TOOL

For FASTER Cut-off Sawing at LOWER COST!

The all-new MILFORD MILBAND is the *first* band saw machine specifically designed, developed and constructed from the bottom up to give you the extra ruggedness, rigidity, variable speed range and other characteristics needed to handle high speed steel band saw blades with maximum efficiency. Built to withstand the heavy feeds and fast blade speeds of which high speed steel blades are capable, the MILBAND Machine takes continuous, heavy duty sawing in its stride without requiring frequent or costly maintenance. Here, in fact, is the machine you need to produce more . . . save more!

MILBAND gives you lowest cost-per-cut . . .

because you get more pieces per man-machine hour. Fully automatic bar feed permits a completely automatic stock feeding cycle. Narrower kerf with at least 50% less chip loss means big savings in material.

MILBAND cuts consistently straighter, smoother, more accurately . . .

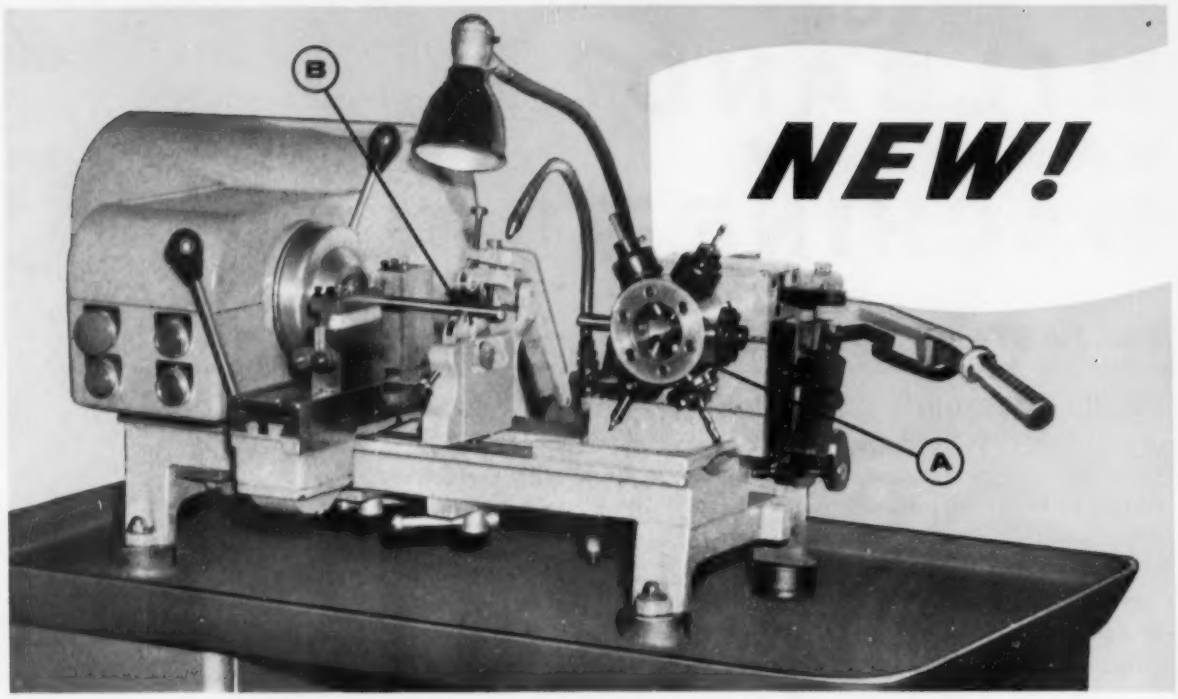
than other cut-off methods. This means less allowance for waste, less subsequent machining time to remove surplus metal.

WRITE NOW FOR COMPLETE INFORMATION . . .

Ask for your free copy of this circular that fully describes all the time- and money-saving advantages of the new MILBAND Machine . . . shows how this machine will help you reduce per-cut costs and cut metal faster and more efficiently than ever before. Remember, the sooner you put a MILBAND to work in your shop, the more you'll save . . . so act today!

The Henry G. Thompson & Son Co., Chapel & Dill Sts.
New Haven 5, Connecticut.





NEW!

CHALLENGE .625" PRECISION TURRET LATHE

for faster handling of secondary operations or short runs on small precision parts

Look at these important new operating features:

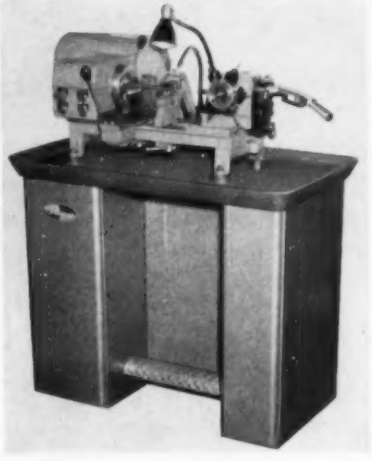
(A) AUTO-INDEX TURRET

Vertical turret automatically returns to starting position when operating lever is lowered, eliminating need for operator to index through all positions to return to starting position. Number of work stations desired can be preset.

(B) AUTOMATIC STEADY REST

Steady Rest automatically opens when turret indexes back to starting position, speeds removal of work pieces.

You'll want to know all about these and many other cost cutting features of the Challenge 625 . . . push button control, easy collet operation, two-post cross slide.



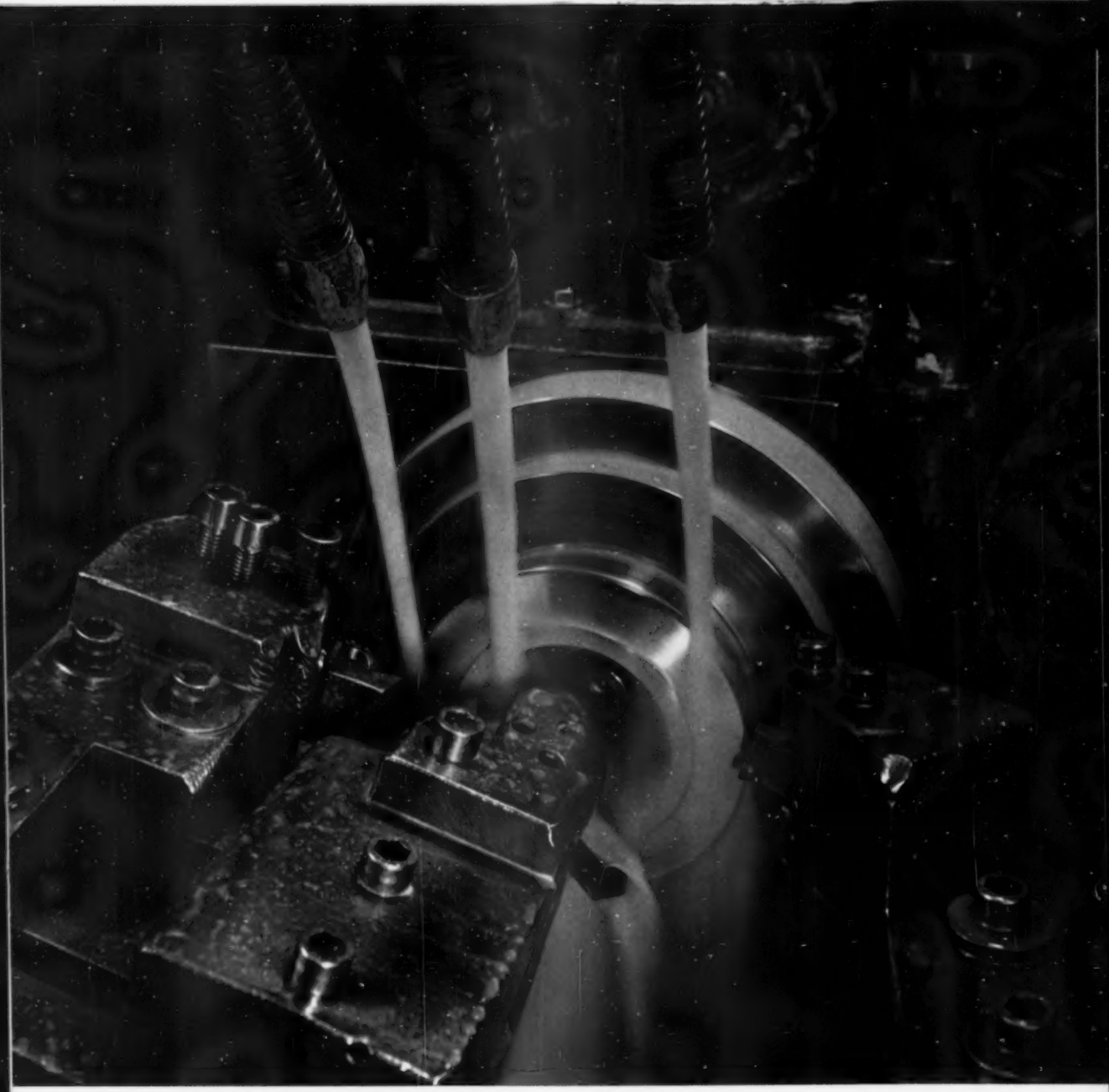
Rigid steel stand is integral part of machine, houses coolant tank and pump. Entire machine is 42" long, 25" wide, 51" high, occupies minimum floor space.

TL-101

Available through selected machine tool dealers. For complete information, write today.

Challenge

THE CHALLENGE MACHINERY COMPANY
107 North First Street
GRAND HAVEN, MICHIGAN



Improved *Lusol* the coolest coolant of them all

Improved Lusol, an oil-free, transparent, water soluble solution, has the highest heat-removing capacity of all coolants, regardless of type.

This means cooler work pieces and cooler tools; makes possible increased speeds, increased feeds, increased accuracy, better finish and *greatly increased tool life.* Summing it up, Lusol means better production at lower cost.

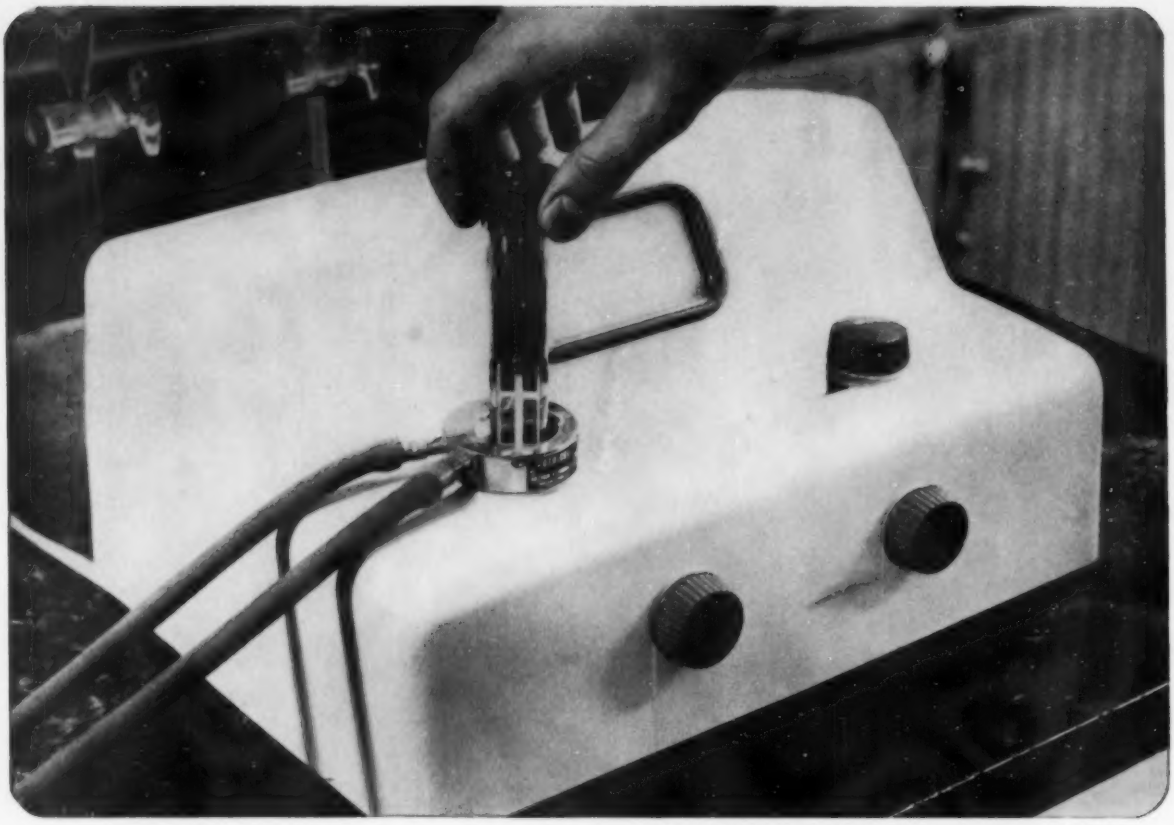
But this is not all—Lusol, an oil-free solution, means cleaner machines and a cleaner plant. It eliminates smell and smoke. It is bland to the hands and cuts out dermatitis. Operators certainly appreciate it. As one said, "I feel as if I were in a new plant—no smell, no smoke, no slippery oily floors—and my wife likes me better when I come home."

Proved for years in hundreds of plants from coast to coast, Lusol is worth investigating NOW. Send for our 16-page illustrated catalog today, describing Lusol and the other Anderson metalworking products.

ANDERSON
OIL and CHEMICAL COMPANY, INC.
BOX 305, PORTLAND, CONNECTICUT
DISTRIBUTORS AND WAREHOUSE STOCKS COAST TO COAST

BETTER PRODUCTS FOR BETTER METALWORKING

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



COLORIMETER (inherently extremely accurate) determines percentages of molybdenum, tungsten, cobalt and manganese in A-L tool steel to insure consistent, high quality.

Colorimeter measures exact chemical composition of Allegheny Ludlum tool steel melts

Accurate adjustment of alloys guarantees uniform heat treatment, predictable dimensional changes, reduced grinding, standardized machining operations.

Close control of molybdenum, tungsten, cobalt and manganese is at the heart of a good tool steel melt. In addition to the usual testing methods, Allegheny Ludlum's chemical laboratory checks these metals with Colorimetry because of its inherent, extreme accuracy.

On the basis of the Colorimeter's findings, it is possible to make carefully calculated furnace additions of ferro-alloys, insuring precise control over chemistry. This guarantees your receiving the *exact* analysis order after order, providing *uniformity of heat treatment, predictable dimensional changes, reduced grinding and standardized machining operations.*

Colorimetry is but one step toward careful control over composition. Allegheny Ludlum also sets exacting purchasing specifications on raw materials and scrap. Quality Control checks all incoming orders to see that they conform with these specifications. Another guard toward your getting your exact specifications: each ingot bears a metal tab showing heat number.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. TE-14

WBW-7262

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

DIE SET DATA

available from **PRODUCTO**



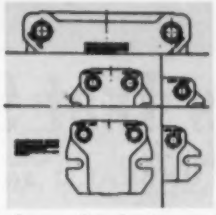
Die Set Catalog No. 11

This easy-to-use general catalog contains compact, complete listings and illustrations of Producto's broad line of die sets and die makers' accessories. There's a separate price book with *net* prices. A unique new binding enables you to have the technical data and price information side-by-side—no flipping back and forth required. *Color* spotlights key information and speeds up your use of the catalog. Many important new accessory items are included. Free.*



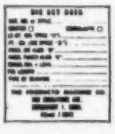
Die Set Digest

Every issue of this 8-page quarterly publication is packed with valuable hints for designers, manufacturers and users of dies. Hard-to-find information is presented clearly in the *Digest:* "Die Set Maintenance in the Pressroom"; "How to Select and Use Die Springs"; "How to Lubricate for Longer Life". Write and ask to receive *Die Set Digest* regularly. No charge.*



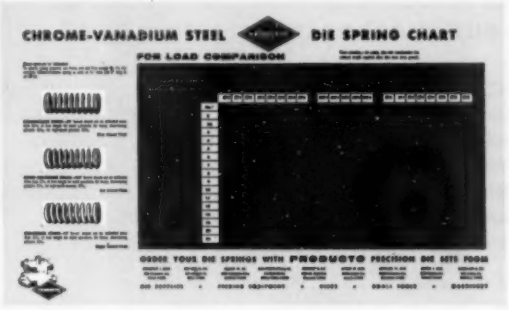
Die Set Templates

Accurate full-size templates for Producto rear-pin die sets. Save time and simplify layout for the busy die designer. $3.50 set. Write today.



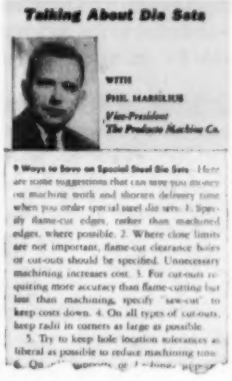
Die Set Specification Stamp

Rubber stamp for tracings, prints. Provides spaces for die set ordering information. Free.*



Die Spring Comparison Chart

Die spring selection is simplified by this 12″ x 20″ chart in two colors, suitable for wall mounting. Convenient for use at the drawing board, bench or in the stockroom. Covers all three series of Producto chrome-vanadium die springs: Medium-pressure 50% deflection, Medium high-pressure 37% deflection, and High-pressure 30% deflection. Free.*



Ad Reprints

Valuable die set know-how is provided in recent "Talking About Die Sets" columns: *How to Save on Steel Specials, Steel vs. Semi-steel,* and others. Send for complete file, free.*

*WRITE TODAY for these useful and informative diemaking aids. Requests on company letterheads will be filled promptly.

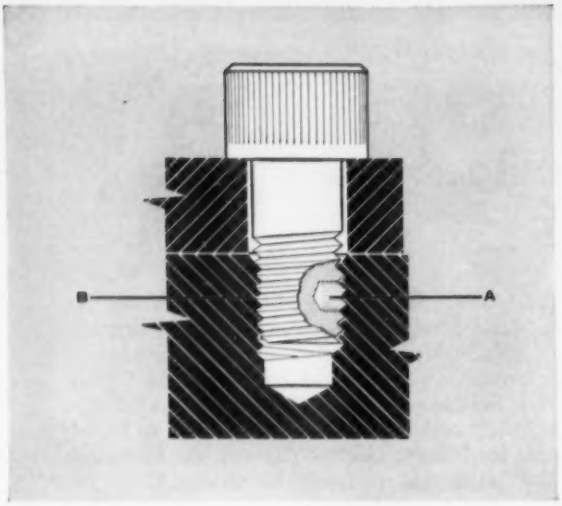


THE PRODUCTO MACHINE COMPANY
930 Housatonic Avenue, Bridgeport 1, Connecticut

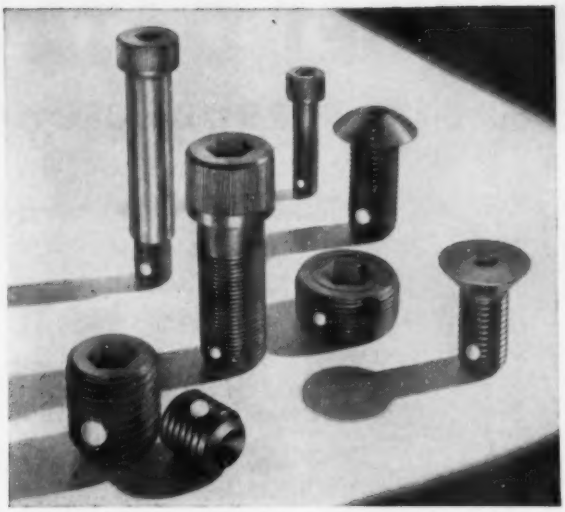
Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS



How Nylok Locks. Resilient nylon pellet (A) sets up lateral thrust, smoothly wedging mating threads together (B). Locking action is entirely on threads and is positive, seated or unseated. UNBRAKOS with Nylok are easy to remove and are reusable.



Self-Locking UNBRAKO Socket Screws, in a full range of standard types and sizes, are stocked by your authorized SPS distributor. Permanently installed locking pellets are serviceable from —70 to +250°F and will not dry out, rot or shrink.

Only Screws That Stay Tight Are Reliable!

Use UNBRAKO socket screws with Nylok*

to increase the reliability of your mechanical assemblies

Fastener reliability is essential not only in the products you manufacture, but also in the machinery you use. Yet 9 times out of 10, the ordinary threaded fastener will work loose if subject to impact, shock or vibration . . . and it usually is. In the case of industrial equipment, this tendency of fasteners to loosen can mean added maintenance costs, production delays, or even damage to machinery. With consumer goods, it can mean extra service calls and repairs—irritating to the customer and, more often than not, unprofitable for the manufacturer.

Past efforts to solve this problem have involved use of lockwashers, cotter pins and wiring. These conventional locking devices are not always completely reliable. Lockwashers sometimes snap or lose their spring; and with cotter pins or wiring partial loosening is likely. Furthermore, these devices take extra time and labor to install.

UNBRAKO socket screws with Nylok offer you a simple, practical solution to this problem of fastener reliability. An UNBRAKO with Nylok is a single self-locking unit—requires no auxiliary fastening elements. The tough, resilient nylon pellet—permanently installed—forces mating threads tightly together, locking the screw securely, seated or not, wherever wrenching stops. It will not work loose, despite severe vibration.

Off the shelf, a self-locking UNBRAKO may cost you slightly more than an ordinary screw. But f.o.b. your product, it usually costs less . . . assembly time, labor and reliability considered. See your authorized SPS distributor for complete details. Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

HIGH RELIABILITY

SPS research is continually developing fasteners with higher and higher standards of predictable performance. By installing SPS high-reliability fasteners in your assemblies, you increase your overall product reliability.

For more information on the full meaning of reliability, write for a copy of the new SPS booklet "High Reliability."

We also manufacture precision titanium fasteners / write for free booklet

SPS **Jenkintown • Pennsylvania**

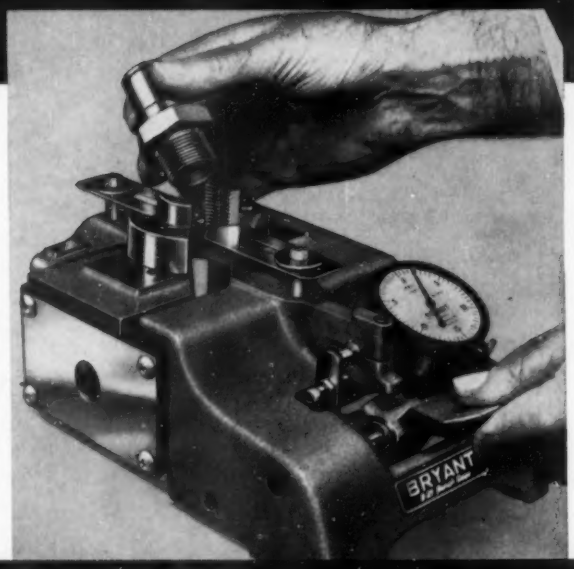
Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co. • National Machine Products Co. • Nutt-Shel Co. • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.

BRYANT

EX-CELL-O

TEAMED UP

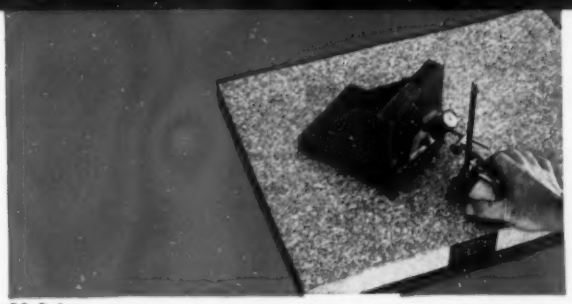
TO BETTER SERVE YOUR PRECISION NEEDS



BRYANT B-21 BENCH GAGE

EXACT READINGS 8 TO 10 TIMES FASTER CHECKING INTERNAL AND EXTERNAL THREADS

Now, two famous names team up to fill all your thread, groove and bore gaging needs! The Bryant B-21 Bench Gage, one of many versatile gages now available from Ex-Cell-O, checks all threads, all forms and classes up to 5". The B-21 uses one rigid casting for the base and stationary gaging segment platform, another as a mounting platform for the movable gaging segment. All segments are fully interchangeable. Standard attachments and special accessories permit a wide variety of uses, including checking squareness of face and concentricity of diameters, and checking parts with standard snap-ring or "O"-ring grooves or special grooves.



59-B-1

BRYANT GRANITE SURFACE PLATES

ROCK OF AGES

UTMOST PRECISION OF SURFACE—UNEXCELLED WEAR RESISTANCE

Only *true* granite, with the Bryant-patented "head of the grain" finishing, can provide surface-wide hardness and homogeneity. Available in standard and special sizes. Welded steel stands of modern design available for all plates.



FREE FACT-FOLDERS—Engineering data, accessory and attachment details, shipping information and prices on the full line of Bryant Internal and External Thread and Groove Gages. Also sent free of cost or obligation: the full story of how Bryant Granite Surface Plates can make a big difference in your lay-out, inspection and assembly work. Read the results of unbiased wear-tests of nearly 30 different surface plates—get *all* the facts before you buy! Same-day reply to every inquiry.

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EX-CELL-O FOR PRECISION

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EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

WILSON "ROCKWELL"

HARDNESS TESTERS

WORLD'S STANDARD OF ACCURACY

ACCO for Better Values

EQUIPMENT for EVERY Hardness Testing Requirement

No matter what your hardness testing requirements are, there's a WILSON "ROCKWELL" instrument to do the job. Choose from this complete selection of hardness testers:

"ROCKWELL"—for most hardness testing functions.

Superficial—for extremely shallow indentations.

Twintester—combines functions of "ROCKWELL" and "ROCKWELL" Superficial testers.

Semi-Automatic (manual feed) and Fully Automatic—for automatically classifying tested pieces as CORRECT, TOO HARD, or TOO SOFT—at test rates up to 1000 pieces per hour.

Special Machines—for testing large objects, obtaining internal readings, and other unusual applications.

ALL WILSON "ROCKWELL" hardness testers provide these advantages:

Accurate performance—precision built, with exact calibration, for consistently correct results.

Long life—durable as a machine tool.

Easy operation—even an unskilled operator can get perfect readings. All controls conveniently grouped.

Easy maintenance—interchangeable mechanisms, with spindles mounted on oil-less bearings.



DIAMOND "BRALE" PENETRATORS

for perfect testing every time

A perfect diamond penetrator is essential to accurate hardness testing. Since one point of hardness on the "ROCKWELL" scale represents only 80 millionths of an inch of penetration—only 40 millionths on a Superficial tester—the slightest imperfection will cause a false reading.

Only *perfect* Wilson Diamond Brale Penetrators are sold. Each diamond is flawless, with no chips or cracks. It's cut to an exact shape. Microscopic inspection and a comparator check of every diamond—one at a time—assure this perfection—and assure you of accurate hardness testing every time.

A COMPLETE LIBRARY of Helpful Information

A wide variety of bulletins tells about hardness testing, and describes the many instruments, accessories, and services Wilson offers. Write for your choice:

DH-325—WILSON "ROCKWELL" Hardness Testers • DH-326—"ROCKWELL" Superficial Hardness Testers • DH-327—Special "ROCKWELL" Testers, including Automatic and Semi-Automatic models • DH-328—TUKON Tester, for precision MICRO and MACRO testing.

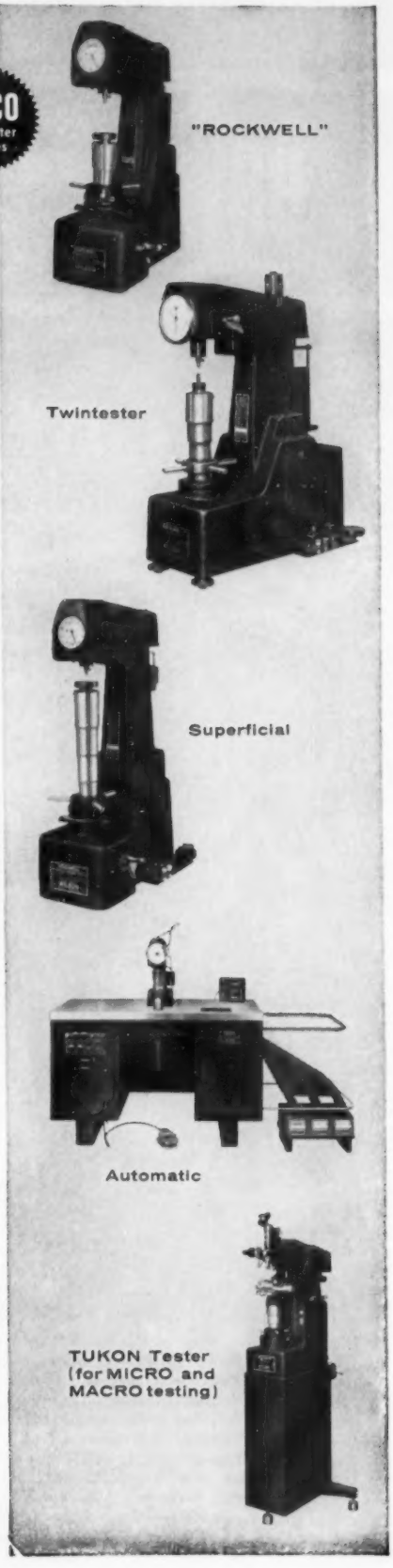


ACCO WILSON

MECHANICAL INSTRUMENT DIVISION

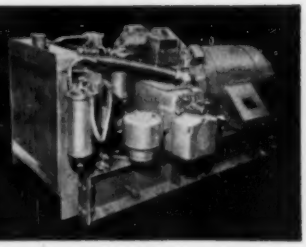
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WITTE ENGINE WORKS
OIL WELL SUPPLY DIVISION
UNITED STATES STEEL

12,000 WATT DIESEL
ENGINE-GENERATOR UNIT



PART: Alloy camshaft and tappet housing for power unit shown above.

SUNNEN HONING MACHINES...

HONING SIX BORES IN THREE OPERATIONS



Range of standard tooling available from stock: ⅛" to 2⅝" dia.

Average installation with tooling runs about $1,000

GUARANTEEING PRECISION, ALIGNMENT, SIZE AND FINISH

Witte Engine Works, a pioneer engine manufacturer, has used Sunnen Honing for over 25 years. They know precision-honed bores have many advantages.

In addition to tandem holes in part shown above ... they Sunnen-hone many pin holes in pistons and rods; bearing seats in rods; crosshead-pin holes in hydraulic pumps ... and many other parts, large and small.

Like Witte, many Sunnen customers first set up to hone one specific job. They find results so satisfactory ... they soon are scheduling a wide variety of I.D. operations (in many parts) on their Sunnen Honing Machines.

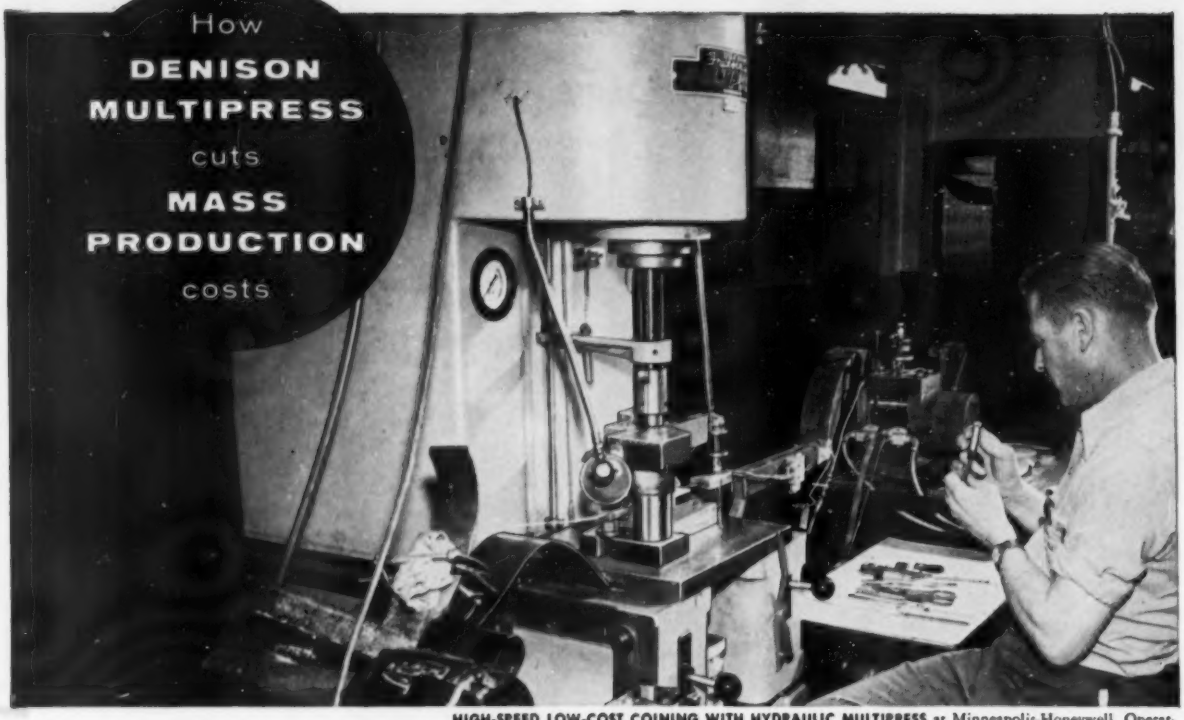
For accuracy, speed and low cost per piece— it can't be beat!

SUNNEN® PRODUCTS COMPANY
HONING

SEE HONING IN ACTION
BOOTH 1157, WESTERN METAL EXPOSITION
MARCH 16-20, LOS ANGELES

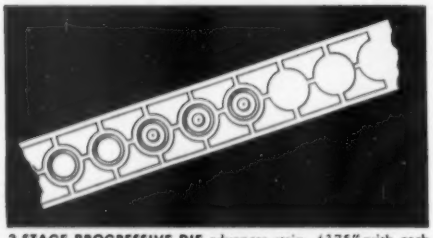
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How **DENISON MULTIPRESS** cuts **MASS PRODUCTION** costs

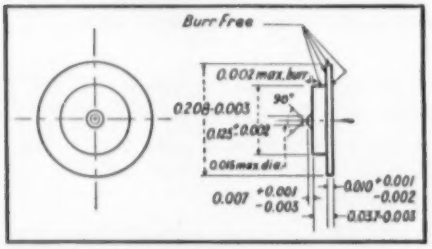


HIGH-SPEED LOW-COST COINING WITH HYDRAULIC MULTIPRESS at Minneapolis-Honeywell. Operating at 225 strokes-per-minutes, modified 8-ton Denison Multipress turns out 70,000 magnesium buttons a day. Automatic controls and safety limit switches permit one operator to handle 3 Multipress lines.

How **DENISON** *hydraulic* Multipress saves cash on high-speed coining for **MINNEAPOLIS-HONEYWELL**



3-STAGE PROGRESSIVE DIE advances strip .4375" with each ¼" Multipress ram stroke. Holes are used for piloting – and for stock advance with hitch feed.



EXTRUDED, COINED AND BLANKED from pure magnesium strip – this button is mass-produced at *extremely low cost* on Multipress. Stock sizing rolls control thickness of strip fed to die. *Denison hydraulic Multipress controlled pressure easily holds necessary precision tolerances.*

High-speed coining of small magnesium buttons is normally a mass production job for an automatic screw machine. *But, Minneapolis-Honeywell found it could do the job better and faster... save money, too... with Denison hydraulic Multipress.*

A modified 8-ton Multipress—equipped with 3-stage progressive die, 6-ton cylinder and special high-speed valves—mass produces about 70,000 of these ordnance-item buttons per 8-hour shift. Coining and blanking the buttons from coiled strip stock with Multipress – instead of using bar stock and a screw machine – *cut costs significantly on the operation.*

The progressive Multipress die—designed by Minneapolis-Honeywell engineers—has 3 working stations. *First station* pierces triangular holes which relieve strip and permit proper impact extrusion. *Second station* extrudes and coins parts to size – but leaves them intact in the strip. *Third station* blanks parts and moves them through the blanking die into waiting containers.

This is typical of hundreds of jobs that Denison Multipress does today throughout industry... to give users the *competitive edge.*

Denison hydraulic Multipress means important *plus benefits,* too – longer tool and die life... less scrap... better quality control... minimum maintenance... greater operator safety.

Isn't it time *you* got the story on Multipress... complete line from 1 to 75 ton capacities. Call or write your Denison Hydraulic Specialist on your very next job.

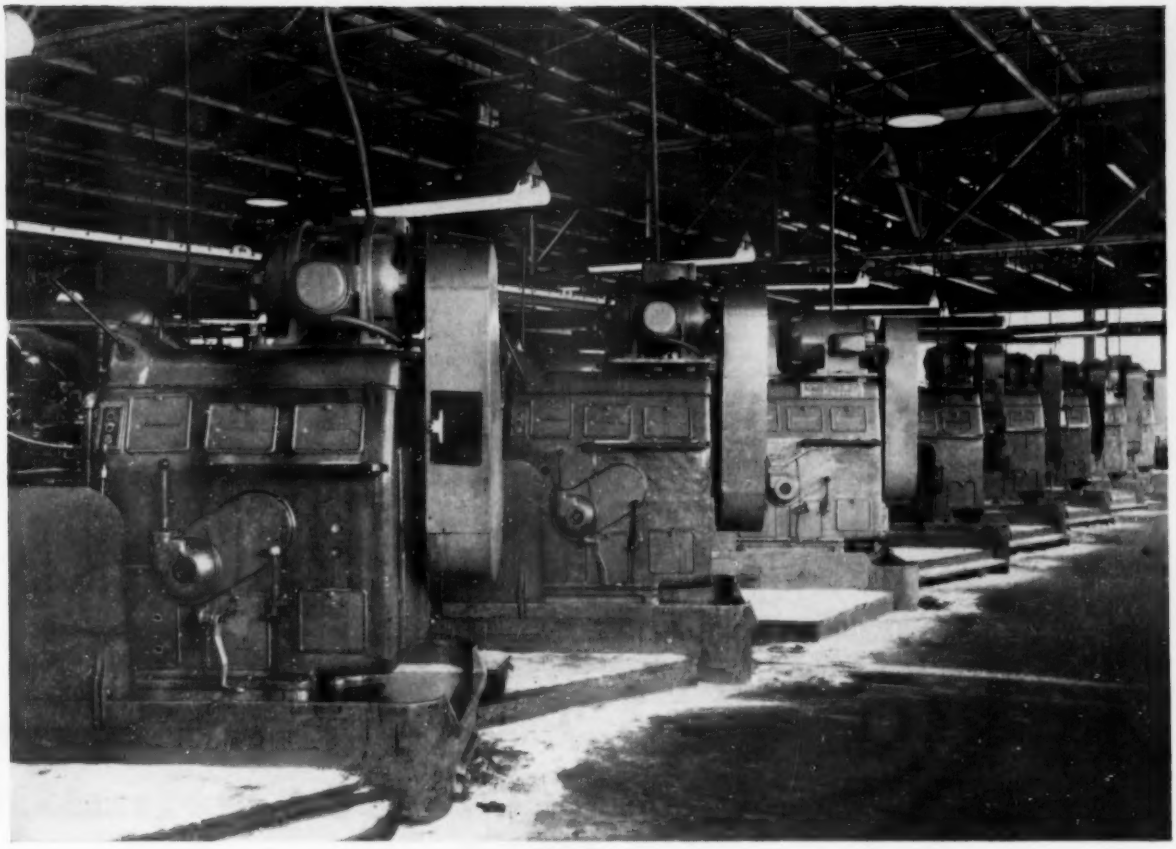
DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1182 Dublin Road • Columbus 16, Ohio

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DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

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Lundberg cuts costs 11% by switching to Timken® hot-rolled seamless steel tubing on National Acme screw machines

TO cut costs, Lundberg Screw Products Company of Lansing, Michigan, investigated the possibility of using hot-rolled tubing on its National Acme screw machines. The question: were hot rolled tolerances adaptable to standard collets.

Timken Company sales engineers suggested they try hand chucking. Although hand chucking would mean a slight increase in time due to minor adjustments of collet tension, the material savings would more than offset the higher labor cost. And it did. The manufacturer found these adjustments added 1/10 of an hour per tube to production time. *But* the saving in material cost was *11%*.

Can hot-rolled Timken® seamless steel tubing save money for you? Call us and see. And to further increase your steel savings, ask Timken Company engineers to recommend the most economical tube size for your hollow parts job. We'll guarantee this size to clean up to your dimensions. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Makers of tapered roller bearings, fine alloy steels and removable rock bits.

Timken alloy steel and seamless tubing is available from warehouse stock in 44 cities in the United States. Call your local Timken Company sales office for the name of your nearest Timken steel distributor.

TIMKEN® *Fine Alloy* STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING



How Warren Pouyer cut grinding

Six years as a tool and die maker gave Bay State's Warren Pouyer a basic knowledge of precise metal working problems that many an "expert" would envy. For the last nine years, he has specialized in abrasives and has gained a tremendously wide knowledge of grinding methods and materials.



Moog operator gets heavy, rapid stock removal using Bay State wheel to grind eye of automobile spring leaf.

costs 1/3 at Moog Industries

Too many wheels were being used up too fast. That was the basic problem in the spring eye grinding operation at Moog Industries, St. Louis, Mo. A leading manufacturer of truck, trailer and automobile springs, Moog makes a complete line of front-end, chassis parts . . . and in this highly competitive business, keeping grinding costs down is vitally important.

So they called in Warren Pouyer of Bay State distributor Mill Supply & Machinery Company and he spotted the trouble right off the bat: disc grinding wheels of a specification that looked as if it *ought* to be right but wasn't. Pouyer specified the proper Bay State wheel using a semi-friable type of aluminum oxide with a unique combination of grit sizes. Production increased 33% per wheel without loss of operation speed.

Since then, the Bay State wheel has been competitively tested over and over again and it has come out on top every time . . . a tribute to Warren Pouyer's ability to specify exactly the right wheel, in this case the first time, and to Bay State's ability to reproduce a given spec *exactly* and *consistently.*

Warren Pouyer doesn't solve all his grinding problems as quickly as this. Like all Bay State representatives, he's trained to study every problem *thoroughly.* And whether a particular problem has a simple solution or a tricky one, you can be sure *your* Bay State man will stick to it until he works out a practical, economical answer. *Better grinding at lower cost – that is his business.*

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities.

save tooling dollars

with this versatile, quick set-up

DUMORE®

AUTOMATIC "DRILL-N-TAP" UNIT



Only $825 *

Complete tool, ready to operate —includes reversing motor, electric tap control, pulleys, chuck.

Do all these operations—*and more*

TAP • DRILL • REAM • CHAMFER
SPOT-FACE • CENTER • DEBURR

Plug it in and it's ready to go

—Any unskilled laborer can learn to operate it in minutes. Once set, it's always set — minimizes scrap loss, drill breakage and eliminates operator fatigue slowdowns. Changes easily, quickly from job to job, operation to operation, for long or short runs. Precision engineering, famous Dumore quality workmanship and separate, isolated hydraulic and pneumatic systems provide trouble-free service over millions of cycles. Less than one cubic inch of air required . . . a cost-cutting feature.

The Dumore Series 28 "Drill-N-Tap" Unit

can be a drilling or tapping machine with just the flip of a selection switch. Tap fits into chuck, no extra attachments required. Reversing motor controls tap, eliminates troublesome clutches. Adjustable, positive spindle speeds from 265 to 4900 rpm. Can be set up for operation in 5 minutes—on drill press or special machine, with simple nose bracket. *For more details, send coupon.*



NOSE MOUNTING BRACKET

Your Key to all-purpose machining—anywhere. It permits fast, easy mounting in any position, angle or direction in single set-ups, or multiple operations in sequence.

You can save hundreds of dollars in first cost alone with these DUMORE AUTOMATIC DRILL UNITS

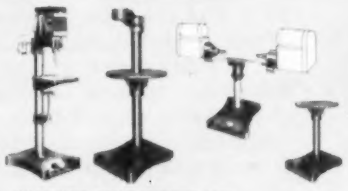
SERIES 24 DRILL UNIT
Fully automatic with all controls built-in for short or long runs and frequent changeovers. From $613*
SERIES 26 DRILL UNIT
Same as Series 24 with just basic controls built-in for long, uninterrupted runs. From $505.50*
SERIES 20
Built-in adjustable controls—automatically selects proper speeds/feeds. No. 80 to 5/32" drill capacity. From $217.50*

*FOB Racine

BUILDING-BLOCK ACCESSORIES FOR AUTOMATIC PRODUCTION



MULTIPLE SPINDLE ATTACHMENT fits units 28, 24, 26. For simultaneous drilling or tapping of 2, 3 or 4 holes. Quickly adjustable center distances.



COMPLETE DRILL PRESSES AND TABLE FIXTURES
Includes Circular and Rectangular Fixture Presses, Cross Arm Bar Assemblies, Circular Production Tables, Variety of Brackets, Control Components and other units to provide complete parts needed for building your own single or multi-purpose drilling or tapping machines for lower cost production.

AND THESE HANDY, USEFUL TOOLS





DRILL GRINDER, resharpens and precision points drills up to ¼".



MICRO-DRILL for drilling holes as small as .0001" diameter, without skilled operators.



HI-SPEED DRILL PRESS, hand operated, bench type, 0-⅛" capacity. And, DRILL SPEEDER, right, fits standard drill press, 17,000 rpm. 0-⅛" capacity.

Sold and Serviced Thru Leading Industrial Distributors Everywhere

You Can Do More with DUMORE

ALL PURPOSE PRECISION METALWORKING TOOLS

VERSA-MIL • DRILL-N-TAP UNITS
DRILLING UNITS • DRILL HEADS
MICRO-DRILLS • DRILL GRINDERS
PRECISION GRINDERS • HAND GRINDERS • FLEX-SHAFT TOOLS • QUILLS AND ACCESSORIES

THE DUMORE COMPANY • 1310 Seventeenth Street • Racine, Wisconsin

Clip to your letterhead

Send me Drill Unit details

Your Name_____

From ROUGH BLANK to FINISHED GEAR *In 5 Seconds*

How? a New Red Ring Broaching Process



ACCURACY:

Pin size to .0009″

Lead to .0008″

Involute error .0003″

Composite error less than .001″



FLOOR–FLOOR: 15 Seconds

CHARACTERISTICS: 87 teeth, 24 pitch, 22° helix, 4″ O.D., ¾″ face—cast iron.

TOOL LIFE: After broaching 26,000 parts, this broach was resharpened by the removal of only .010″ of metal. In other cases, production would be governed by operating conditions.

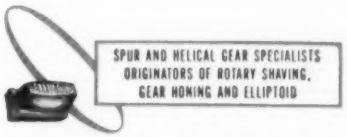
REPLACES SIX HOBBING MACHINES

8168

The above are actual production figures showing the possibilities of this amazingly effective broaching process.

The consistent precision and speed attained do not depend on the operator. They are engineered into the tooling.

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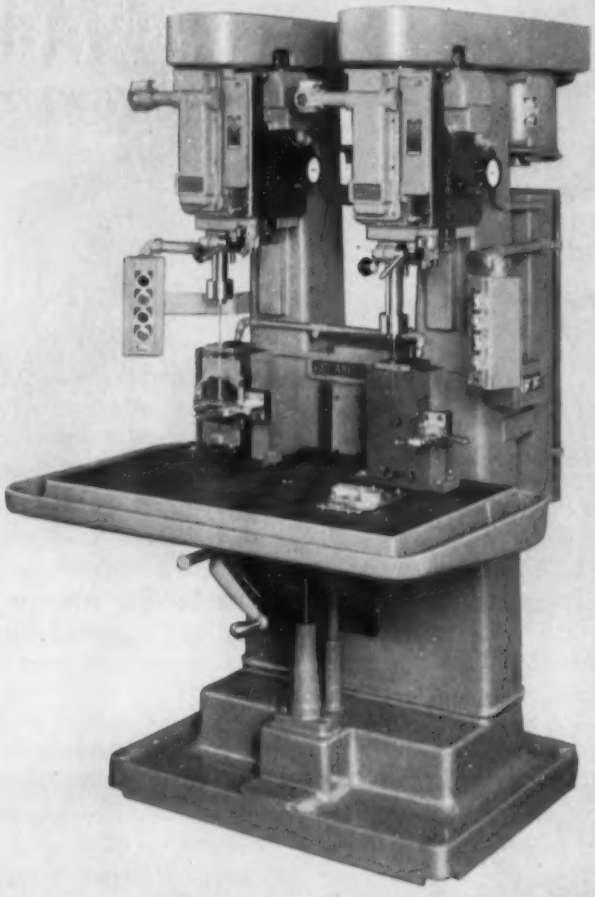
at 250 pieces per hour

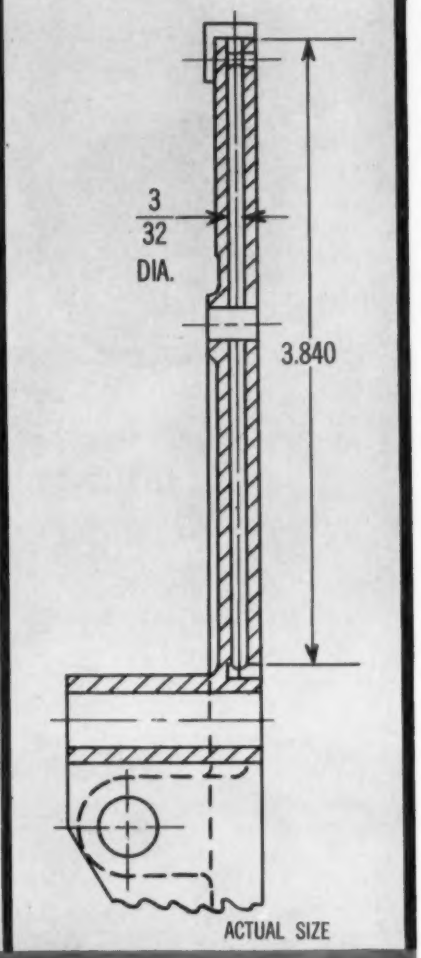
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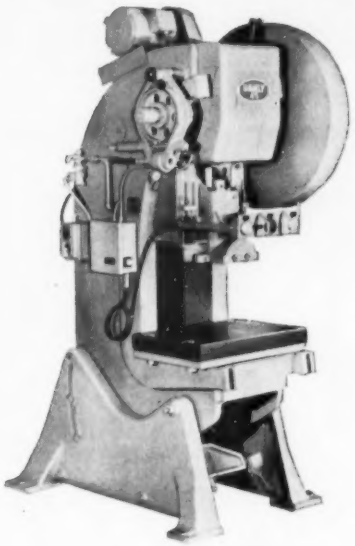
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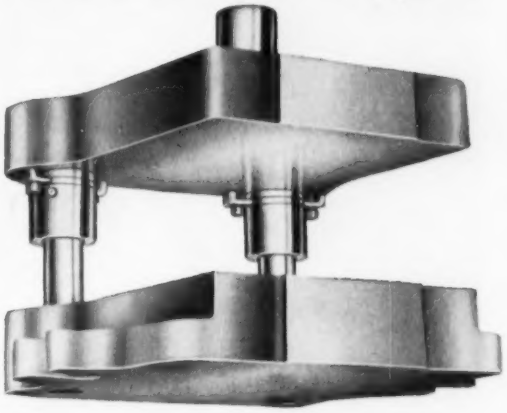
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Danly is now working on its fifth million in die set production. Included in this production are many die sets for the automotive industry—that are working in that industry in its multi-million car production of today.

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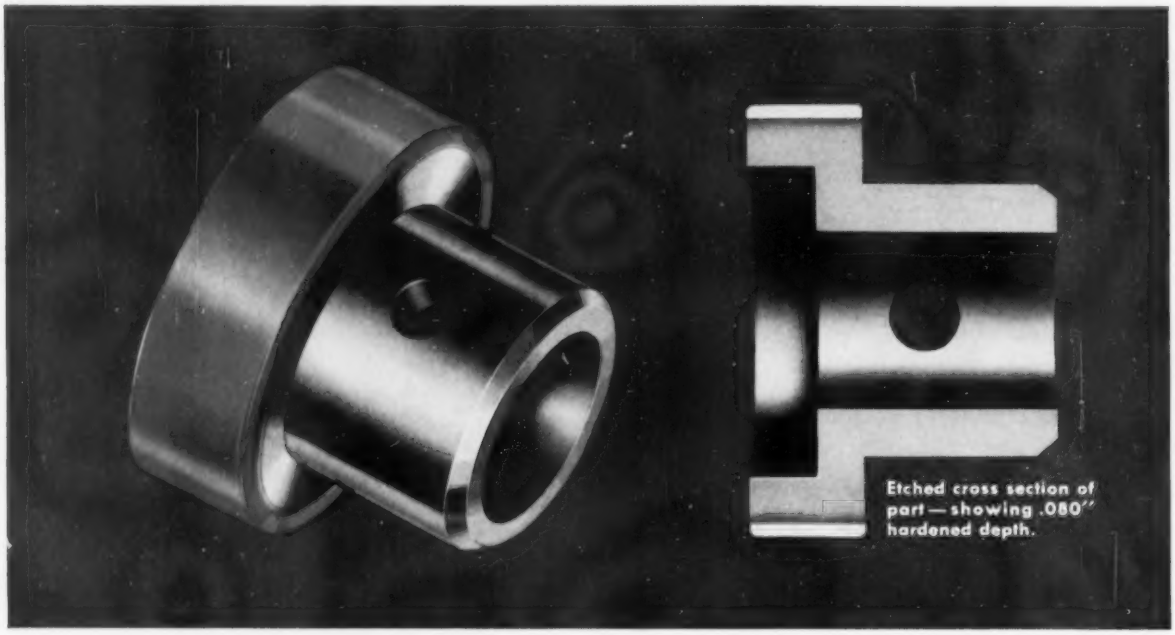
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Costs Cut 94%

with

TOCCO* *Induction Heating*

A cost reduction of 94% resulted when heat-treatment of this Corn Harvester part was changed from carburizing to TOCCO-hardening. Look at the unit cost breakdown:



CARBURIZING		TOCCO-*Hardening*	
Degrease	$0.0020	eliminated	
Carburize	0.0200	eliminated	
1st quench	0.0150	TOCCO, heat and quench	$0.0060
2nd quench	0.0150	eliminated	
Draw	0.0050	eliminated (self-draw)	
Shotblast	0.0035	eliminated	
Internal Grind	0.0243	eliminated	
External Grind	0.0166	eliminated	
	$0.1014		$0.0060

"...Savings of 9½ cents per piece—$4770.00 on each 50,000 piece batch, *plus* an hourly production increase from 120 to 300 pieces per hour, plus improved quality of the product by virtue of the deeper case and stronger core."

Have you investigated TOCCO's cost-savings possibilities for your hardening, brazing, melting or forging operations? Why not write us today or send blueprints of your parts—no obligation, of course.



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Reflections on Elections

One of the most important democratic principles in the American way of life is our freedom to choose our leaders. Built on the solid foundation of the Constitution developed by our forefathers, our laws and customs have permitted progress far beyond the expectations of those inspired few who wrote it.

So it is with the American Society of Tool Engineers. The men who twenty-seven years ago founded this Society, provided a constitution which affords the same democratic privilege of selecting our own leaders. It has done its work well as a strong foundation on which to build.

With progress and changing times it has been necessary to amend our National Constitution. We have found the same action necessary within ASTE. In fact, your Board of Directors is currently engaged in a long-range planning study which will cover every facet of our Society's government, objectives, organization, finance—everything which affects the Society in any way.

A tremendous amount of work and thought must go into such a study. Much of it may be only a review of the past and present. There may be a few changes recommended but we will have the combined experience and constructive thinking of the leaders whom you have elected to guide us in this study.

The power of selection of our own leaders is not only a privilege, but a responsibility. This thought should be uppermost in our minds when we cast our ballots this month for our new chapter officers. From the chapters comes the leaders of the future in the national organization—our national committeemen, our board members and our officers.

It therefore becomes of great importance to choose the best. In this respect we have been fortunate, and if we continue to look for men with good judgment, planning ability and constructive leadership, our progress is assured. The same objective applies to chapter committee personnel, the training ground for future chapter officers.

Elections are democracy in action. May we always accept this responsibility as our best means of preserving the privilege of making our own choice.

G. A. Goodwin
PRESIDENT

American Society of Tool Engineers

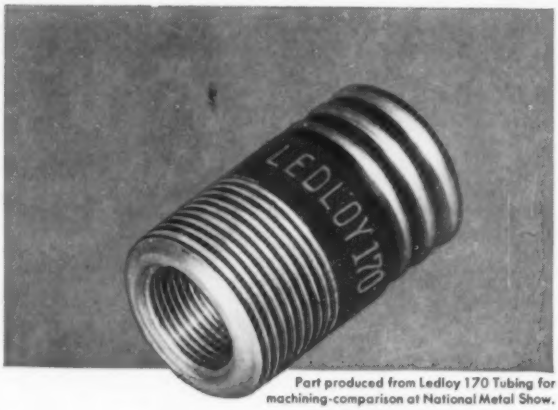
NEW LEADED STEELS FROM RYERSON

Now, machine parts faster than ever before

NEW LEDLOY 170 TUBING

average machining speed 170 surface feet per minute

Here's the fastest-machining steel tubing ever produced —and only Ryerson has it available for immediate shipment from stock. Ledloy® 170 is a cold drawn, seamless product of low carbon analysis with .15% to .35% lead added. It promises a minimum increase of 25% in productivity of machined parts or components. Sizes range from 1" to 2½" O.D. with maximum ⅜" wall thickness. Other sizes can be supplied promptly.



Part produced from Ledloy 170 Tubing for machining-comparison at National Metal Show.

NEW LEDLOY 375 BARS

average machining speed 375 surface feet per minute

This newest addition to Ryerson free-machining screw steel stocks is the world's fastest-machining steel. Assigning the figure 100 to B-1112 and using this as a base, Ledloy 375 has a machinability index of 205 plus. It rates about 64% higher than B-1113 and about 20% higher than Ledloy 300.

Ledloy 375 bars presently in Ryerson stocks include rounds in sizes from ¼" to 1", hexagons ¼" to ⅝".

Ask your Ryerson representative for complete details on these new steels. And call Ryerson for an unequaled selection of cold finished bars and tubing, including the largest stocks of Ledloy 300 (also known as Ledloy A) and Rycut® leaded alloys—the fastest machining in their carbon ranges.

MACHINING COMPARISON*
Ledloy 170 Tubing vs. Nonleaded Tubing

	Ledloy 170		MT-1015	
	Speeds	Feeds	Speeds	Feeds
Center drill	172 s.f.m.	.005"	110 s.f.m.	.005"
Form tool	172 s.f.m.	.0008"	110 s.f.m.	.0008"
Boring tool	172 s.f.m.	.007"	110 s.f.m.	.007"
Cutoff	172 s.f.m.	.0013"	110 s.f.m.	.0013"
Thread	27 s.f.m.	—	20 s.f.m.	—
Tap	18 s.f.m.	—	12 s.f.m.	—
Production time	35 seconds		49 seconds	

* As demonstrated at National Metal Show, Cleveland, 1958.

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controlling MANUFACTURING COSTS

Successful companies use cost accounting techniques for estimating, allocating and controlling manufacturing costs. The author shows—in step-by-step fashion—how material, labor and overhead costs are determined and how they can affect tooling decisions.

By James H. Greene

Associate Professor of Industrial Engineering
Purdue University
West Lafayette, Ind.

MAKING A PROFIT is the objective of nearly all manufacturing companies. From the point of view of a tool engineer, profit is the difference between manufacturing cost and selling cost. Some of this "profit" is absorbed by sales, administrative and similar expenses that are not controlled by tool engineers. There are only two ways to increase profits: the selling price can be raised or costs can be reduced. Prices are largely controlled by the law of supply and demand, so management looks to the tool engineer for ways to increase profits. And tool engineers must know, in detail, what those costs are.

Manufacturing costs are the sum of three elements: direct material cost, direct labor cost and burden. These costs are estimated before a product is manufactured, for the purpose of determining economic feasibility or for developing prices. Also, costs are often accumulated during or after manufacture to determine the profit picture. In either case, the objective is to determine the cost as quickly and as accurately as possible.

Direct Material: The direct material cost is, of course, the cost of the raw material used to make the product. However, if turnings, cutoff bar ends or other scrap have high salvage value, the sale price can be credited to direct material costs.

When a part is in production, direct material costs are obtained by determining the gross weight per part and multiplying this figure by the material cost per pound. For estimating purposes, material costs are determined by consulting handbooks for the weight of various shapes and sizes of raw stock. The amount of material required for a bolt, for instance, is determined by calculating the length of bar stock required per bolt.

If the scrap has value, the net weight of the bolt can be calculated by determining its volume and multiplying by the weight per unit volume of the material. Net weight of the product is then subtracted from the gross weight of material used per part to determine the weight of scrap.

Direct Labor: To determine direct labor costs, the hourly wage rates of the workers directly involved in producing the part (machine operators, for instance) are multiplied by the time (standard hours) required to manufacture the product. The



Direct labor cost is the cost of all of the labor directly involved in manufacturing a product.

cost of indirect labor such as maintenance is disregarded at this point.

Determining the total amount of direct labor per product is simple when a part is in production: time standards or average hourly production rates are readily available. For estimating purposes, the amount of labor required to manufacture a product can sometimes be determined by checking standards for similar products. If the product is of a new design, the job can be analyzed to determine what elements of work are involved. Standard time values for these elements are frequently available from plant time study data. Handbooks containing time data tables are to be found in most libraries and are helpful if no plant data are available.

Burden: All of the costs of manufacturing that are not included in direct material or labor costs are included in burden. These costs include items like the salary of the plant nurse and the water used in drinking fountains, as well as depreciation, taxes, administration and similar costs. It would be impossible to charge these costs directly to a product unless only one product were made in a plant. Accordingly, a prorating method is used to distribute burden costs.

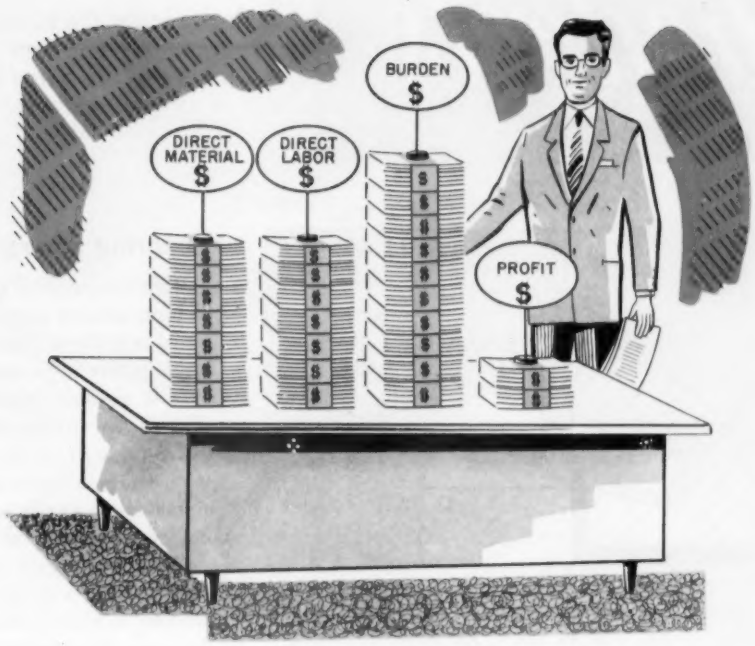
Burden is usually computed as a percentage of direct labor dollars. Most often, burden rates are established by the total burden cost for a plant or department over a given period (say one year or one month) and dividing this figure by the total number of direct labor dollars worked during the period. Direct labor dollars per piece are then multiplied by the burden rate to obtain the burden cost per piece. Burden, being based on past performance, is almost always an approximation and subject to change.

In some situations, direct labor may not be a satisfactory basis for computing burden costs per piece. This is particularly true in highly automated production, where direct labor costs can be an insignificant percentage of the total cost of a product. In such cases, direct material costs or a combination of direct material and labor costs may be a better basis for computing burden costs. Total weight of material melted or cast is a typical base in foundry operations. In woodworking industries, the number of board feet of lumber processed is another possible base. Whatever factors are used, they must maintain a correct or nearly correct ratio for all volumes of production and figures must be readily available.

When there are several different manufacturing processes in a plant, use of the same burden rate



Indirect labor costs cannot be directly charged to a product. They include the plant nurse's salary, the pay of maintenance workers and the like.



Profit is what is left over after direct material, direct labor and burden costs are subtracted from the selling price of the product. When costs are known, efforts can be made to reduce them, thereby increasing the margin of profit.

for all processes can cause difficulties. The case of plant having two departments: one equipped with large multiple-spindle automatic screw machines and the other equipped with small hand screw machines is an example. Total burden costs for the two departments might average $100 per hour. This is the total cost of overhead in the plant.

If both departments use the same number of direct labor dollars, then the actual burden will be $50 for each department. The department with automatic machines, however, will be much more productive than the department with the hand machines. Thus the burden cost per piece will be disproportionately low in the automatic department and correspondingly high in the hand machine department. Consequently, the automatic department will be highly competitive, costwise, and the hand machine department may not be able to meet competition, even assuming that it is highly efficient.

Situations like this emphasize the need for departmental burden rates. These can be obtained by segregating burden costs by departments. The burden cost for a department is normally made up of indirect labor, indirect material and indirect expense. Indirect labor is defined as labor cost that cannot be charged directly to a product but can be charged to a department. Labor used in maintaining machines is an example. Indirect material, like indirect labor, cannot be charged to a specific product where more than one product is run. An example is repair parts for machines.

All other burden costs that cannot be charged directly either to a product or a department are considered to be indirect expense. Such expenses are charged off to departments by means of a ratio. Heating costs might be charged on the basis of floor space. Power costs can be prorated on the basis of machine horsepowers, taxes on machine values.

Once all costs are known, they are summarized. A cost summary sheet is used to highlight areas where cost reduction might be possible. A change in material specifications or salvage of chips could substantially lower material costs. More efficient machining methods could lower direct labor costs and, since there would be less direct labor per piece, also lower burden costs. Experience in industry has proved, time and again, that determining actual costs is the first step toward greater profits.

COST SUMMARY SHEET

Order Number 1959-10

Product 10 brass parts

Direct Material Cost

5 lb/part x 10 parts/order = 50 lb/order
50 lb x $0.50/lb = $25.00

Direct Labor Cost

1 hr/pc x 10 pcs. x $2.80/hr = $28.00

Burden (rate determined as 150 percent of direct labor cost)

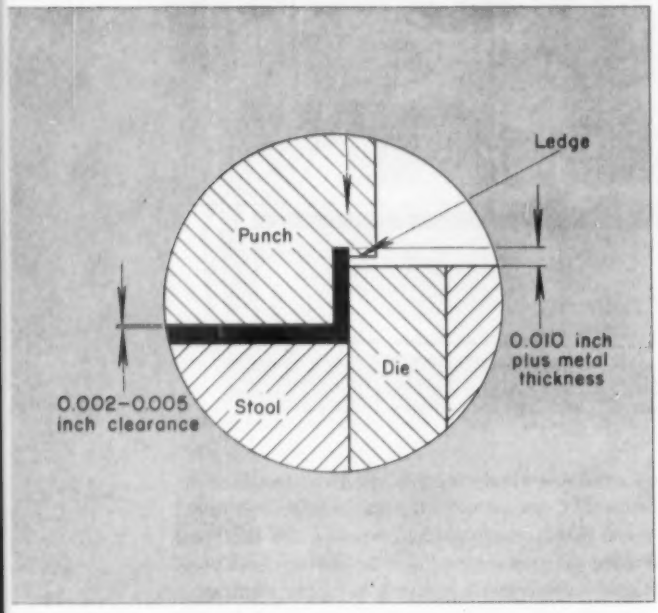
150 percent x $28.00 = $42.00

Total Cost

Direct Material	$25.00
Direct Labor	28.00
Burden	42.00
	$95.00

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work



Forming Sharp Corners

With conventional punch designs, it is impossible to form corners with small radii. The punch illustrated is being successfully used to form cups having inside corner radii smaller than the metal thickness. This is possible because the punch traps the top edge of the straight-down cup under a ledge and drives the wall of the cup down to a spring-loaded stool. The action produces a sharp corner, leaving no marks on the inside or outside of the cup. Depth of the ledge varies from ½ to full metal thickness.

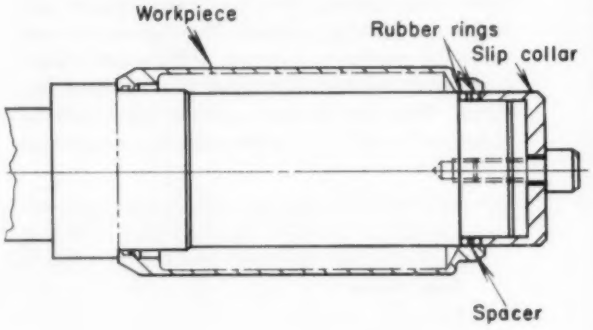
The punch, which is a modification of a coining punch, is used in a 15-station progressive die to produce a close tolerance stamping. It not only sharpens the corner radius but also sizes the outside diameter to final size. With 0.034-inch-thick 1020 carbon steel it is possible to obtain a 0.005-inch corner radius. The bottom of the cup is flat to within 0.002-inch total indicator reading. Production is 200 strokes per minute on a 60-ton press.

D. C. Paquay, Cleveland Chapter

Machining Thin-Wall Parts

Distortion is often a problem when machining thin-wall parts. To overcome this difficulty a special turning arbor was used for the workpiece illustrated. The workpiece is 1/16-inch-thick aluminum. It is a slip fit on the arbor and is driven by friction on two rubber rings. These rings are expanded by tightening down the slip collar as shown. Turning is done on a tracer lathe, using a carbide tool. Speed is 900 fpm; feed is 0.007 ipr. No distortion is encountered in using the arbor.

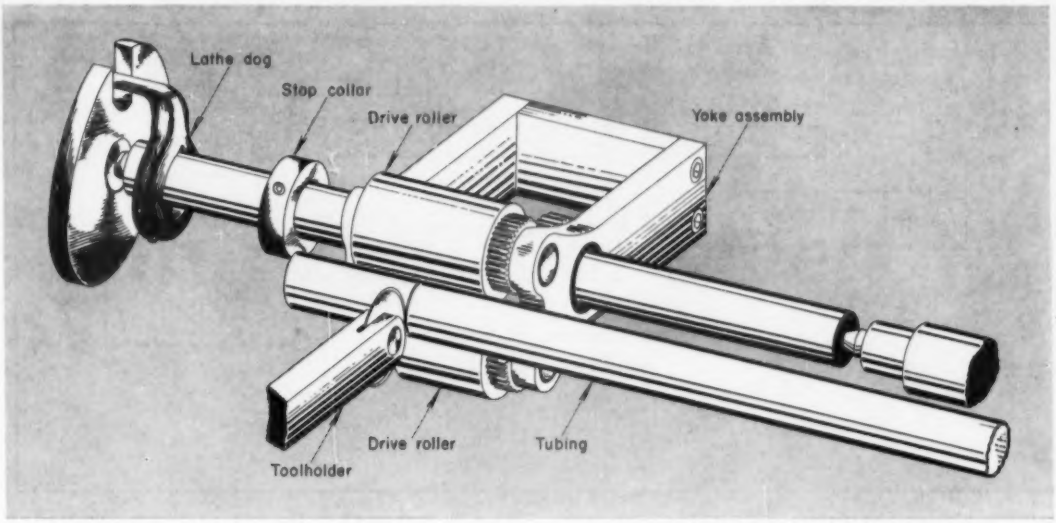
James C. Mitchell, Houston Chapter



Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Honorariums for accepted articles are sent upon publication.

Tubing Cutoff Fixture

When it was necessary to cut off large quantities of thin wall tubing of various diameters into a variety of lengths, the lathe fixture illustrated gave excellent performance. A shaft, mounted between the lathe centers, passes through a yoke assembly as shown. Bushings in the yoke provide a running fit on the shaft. The front end of the yoke carries two short shafts that also run in bushings. Gears on each shaft mesh with gears on the main shaft. The



yoke assembly is held in approximate position for cutting by a tension spring that runs from the back of the yoke to a convenient point on the back of the lathe carriage. This spring is not shown on the drawing.

An adjustable collar on the drive shaft serves as a stop to control the length of the piece cut off. Cutting is performed by a roller type cutter such as those used on pipe cutters. The cutter is mounted on a bar secured to the tool post or clamped to the compound.

The outboard end of the tubing is supported by a feed tube or by sets of rollers mounted on brackets secured to the lathe bed. To give adequate clearance for the tubing, it may be necessary to remove the tailstock handwheel and substitute a small-diameter hand knob.

In operation, the tube is placed on the support rollers and against the drive rollers. The tube is advanced until it strikes the stop collar. Cutting is accomplished by hand feeding the cutter or by using the cross feed. When the length of the tubing is short, the free end can be supported by the operator by allowing the tube to rotate in his hand.

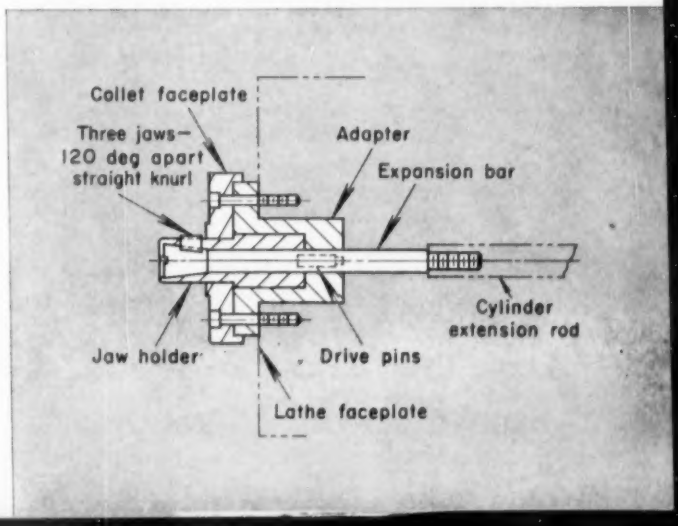
If a lathe with a lever-operated cross slide is available, it can be used to advantage with this fixture. With the arrangement shown in the drawing, the end of the tube rolls against the stop collar and there is some dragging at this point owing to the speed difference. This is not serious but if desired a turret lathe ball-bearing stop can be mounted in a bracket and secured to the lathe bed. In this case the stop collar is dispensed with. In production, the cutter has demonstrated its ability to perform cutoff operations at a rapid rate.

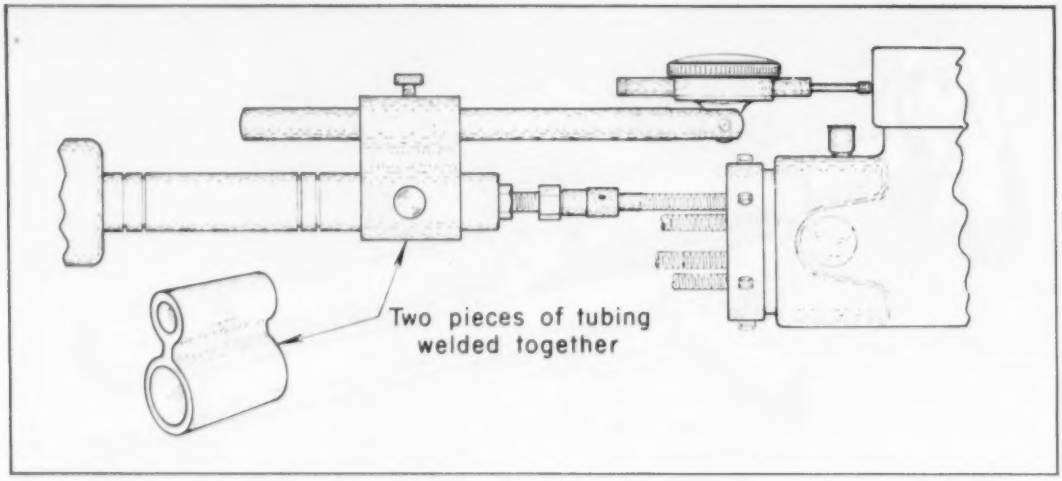
Clint McLaughlin
Rockaway Beach, N. Y.

Automatic Lathe Collet

When heavy cuts are taken, conventional collets may not give satisfactory results. The collet illustrated is used for machining projectile noses having 1½-inch diameter bores and 3-inch outside diameters. The tool for turning the OD is 1½ inches wide at the cutting edge. This is a plunge cutting operation. Production experience over a four-year period has demonstrated that the collet is fully capable of standing up under the heavy loads involved. Many conventional collets were tried out during the same period, with poor results.

Carl R. Parsons, Western Reserve Chapter





Turret Lathe Stop

Especially good accuracy on longitudinal dimensions of turret lathe work can be gained with a dial indicator. By regulating the carriage travel according to the indicator, bringing the pointer to zero each time, better accuracy can be obtained than by using the regular stops alone.

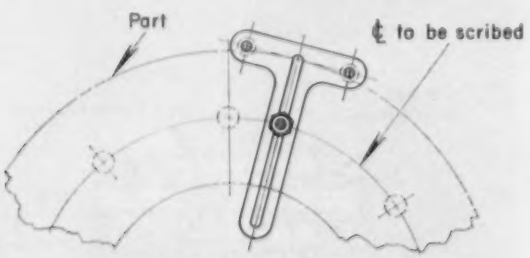
The attachment shown comprises two pieces of mechanical tubing welded together, an indicator and an indicator holding rod. In addition, a contacting spot should be cleaned on the carriage or a small plate mounted with screws. It is desirable to use a long-range indicator—many dimensions will fall within its range. For dimensions in excess of the indicator range, Jo-blocks may be used for the setting.

Everett L. Sweet, Mid-Hudson Chapter

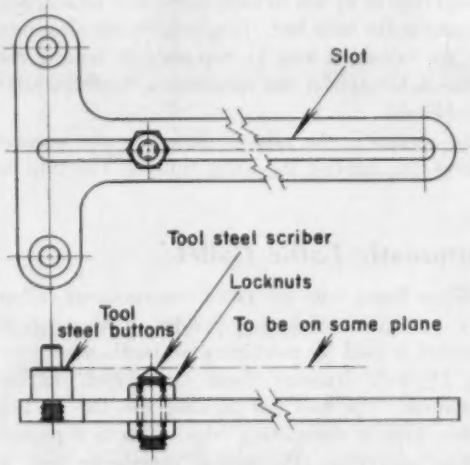
Scribing Tool

Scribing circular lines can be a difficult and time-consuming operation when no accurate center line is available on the workpiece. The tool illustrated makes it possible to scribe circular lines quickly and accurately if the outside or inside edges of the part are accurately machined. Such a scriber is easily made. The body is aluminum and the buttons that contact the workpiece are tool steel.

Detlef Schiling, Toronto, Ontario



SCRIBER IN OPERATION



SCRIBER DESIGN

GRINDING
sulfurized tool steels

By L. P. Tarasov*
Research and Development Dept.
Norton Co.
Worcester, Mass.

Sulfur additions make high-vanadium tool steels easier to grind, the improvement being greatest for those steels that are most resistant to grinding.

ONE OF THE PRINCIPAL ADVANCES in tool steels since 1945 has been the development of the high-vanadium types of high-speed steels and cold-work die steels. Most of the vanadium is present in the form of extremely hard carbide particles which increase the wear resistance of these steels to a marked extent and also make them considerably more difficult to machine and to grind.

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Recent developments have improved the machinability of these steels through the addition of sulfur, generally in the range of 0.08 to 0.15 percent. Methods have been devised to distribute the sulfur throughout the steel so that it does not have an adverse effect upon mechanical properties. Free-machining tool steels have been in use for several years and enough experience has been gained to show that they have essentially the same wear resistance as the corresponding steels to which sulfur has not been added. However, no information has been published as to whether the free-machining varieties are any easier to grind.

Consequently, grinding tests were conducted on both the regular and free-machining varieties of the AISI M2, M3 (Type 1) and M4 molybdenum high-speed steels. These contain approximately 2, 2.4 and 4 percent vanadium, respectively, and, in the regular varieties, are known to be progressively more difficult to grind in the order given. A D7 high-carbon high-chromium steel containing 4 percent vanadium was also evaluated. The nominal analyses of these steels are given in TABLE 1,

and the Rockwell hardness values of the test blocks are also listed. Test blocks were 1½ inches square and 6 inches long, and were ground lengthwise.

The grindability of these steels, or the relative ease of grinding them, was obtained from surface-grinding tests, supplemented by a form-grinding test performed on the M4 steel. It was expressed as usual in terms of the grinding ratio, defined as the volume of metal removed per volume of wheel wear. The grinding ratio has been found to be the best measure of the grindability of various materials for the particular test conditions that are used. If these are changed sufficiently, the ranking of the materials may also change.

From a practical standpoint, the grinding ratio

Table 1—Steels Tested for Grindability

Steel Type (AISI)	Nominal Analysis C	W	Mo	Cr	V	Hardness (R_c)
M2	0.8	6.0	5.0	4.0	2.0	61
M3*	1.0	6.0	5.0	4.0	2.4	66
M4	1.3	5.5	4.5	4.0	4.0	63
D7	2.3	--	1.0	12.0	4.0	65

*Type 1.

is particularly important when it is very low and the area of the work surface is large compared to that of the wheel face, as frequently happens in die grinding. Under extreme circumstances, a wheel of suitable specifications may wear so rapidly that a flat and parallel surface cannot be obtained except at great cost. An improvement in the grindability of the steel may be all that is needed to make it usable. On the other hand, when wheel wear is reasonably low because the grindability of the steel is high enough for the work and wheel surface areas involved, an improvement in the grindability of the steel is of no real advantage except that the wheel life may be extended somewhat.

Surface-Grinding Study

Testing was carried out on a 6 x 18-inch Norton horizontal-spindle, reciprocating-table surface grinder with a soft vitrified-bond 60-grit aluminum oxide wheel (32A60-H8VG) such as is recommended for low-grindability tool steels. The wheel was eight inches in diameter and ½ inch wide. Wheel speed was 6000 fpm and table speed was 750 ipm. Unit crossfeed was 0.050 inch after each table traverse and unit downfeed was 0.001 inch after each complete crossfeed. Total downfeed was 0.010, 0.020 or 0.040 inch after pregrind.

The wheel was diamond dressed prior to each run and was then broken in by a preliminary run on the test block. This pregrind conditioned the wheel face so that the subsequent ratio of material removal to wheel wear remained constant.

Material removal and wheel wear were readily determined by micrometer measurements. The high-speed steels were surface ground dry and with a 1:80 mixture of a widely used soluble oil and water; the D7 die steel was ground only with plain water containing one percent of nitrite-amine rust-inhibitor solution. A check test on the regular variety of the M4 steel showed that the grinding ratio was similar with water or soluble oil.

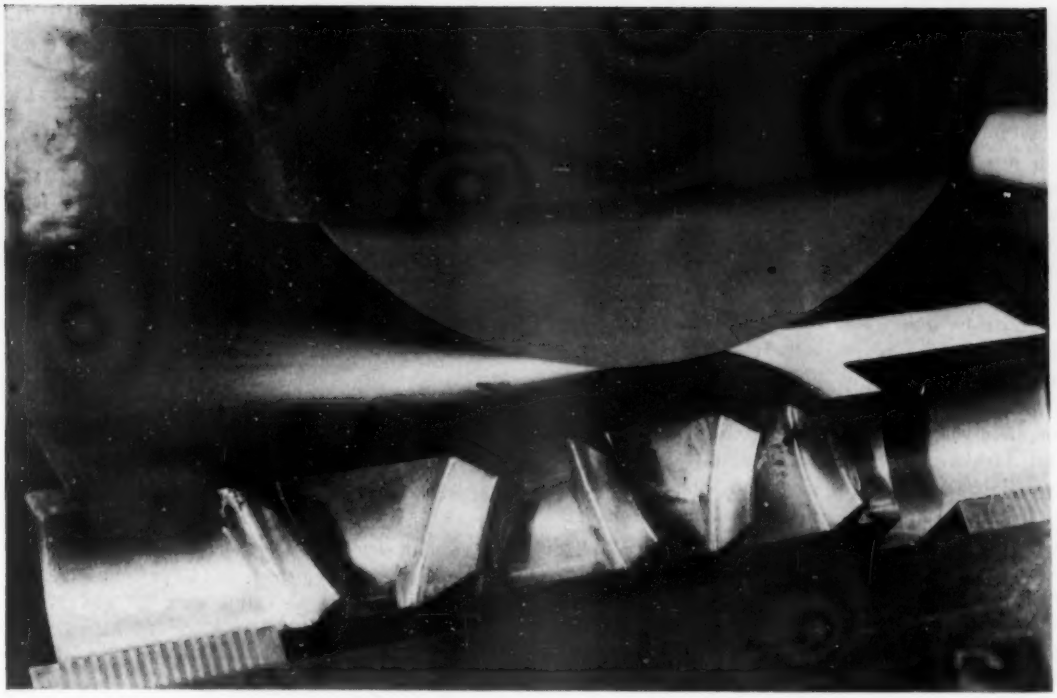
It was found in every instance that the grindability of the free-machining steel was considerably higher than that of its regular counterpart, as shown by the grinding ratios in TABLE 2. The lower the grindability of the steel in its regular condition, the greater was this increase on a percentage basis. For example, when grinding was done dry, the increase was 100 percent for M2 but it was 240 percent for M4, which is much more difficult to grind because of its higher vanadium content. Thus the higher the vanadium content of a tool steel, the greater is the grinding benefit likely to be obtained from the sulfurization of the steel.

Grinding ratios were considerably lower for wet grinding than for dry, in keeping with general grinding experience. The improvement in the grinding ratio for the free-machining steels was likewise considerably less for wet grinding.

Hardening Temperature

The effect of hardening from a higher or lower temperature than normal was investigated since it was felt by one steel supplier that there might be a small difference between the equivalent hardening temperatures for the regular and free-machining varieties of a steel. If such difference exists, and if the grindability varies rapidly with hardening temperature, the superior grindability of the free-machining steels could be due not to the sulfur addition as such but rather to the fact that the two varieties of steel were not hardened from the same equivalent temperature. Test blocks of both varieties of the M3 high-speed steel were hardened by oil quenching from 2210, 2240 or 2270 F, the intermediate temperature being the normal one for this steel. They were all triple tempered to the same hardness, R_c66.

Grinding ratios that were obtained are presented in the upper half of TABLE 3. Data for the intermediate hardening temperature are the same as appeared for this steel in the preceding table. It can be seen that the grinding ratio decreases somewhat when the hardening temperature is raised,



Use of free-machining tool steels results in faster die grinding.

but this change is much too small to account for the far bigger difference between the regular and the free-machining varieties, particularly for dry grinding. The reduction in grindability with increased hardening temperature can be explained by the greater solubility of the carbide particles in the steel. This raises the amount of alloy in solution so that the steel becomes more resistant to grinding and the grinding ratio decreases.

Power input to the motor was also measured during these test runs. Most of the power input, corrected for idling power, is used in heating the workpiece. Thus a lower power value means that less heat is generated in grinding when the feeds and speeds are kept the same. The lower half of TABLE 3 shows that the power consumption was slightly less for the free-machining steel regardless of the hardening temperature. It follows that a free-machining tool steel can be expected to grind a little cooler than its regular counterpart.

When grinding was done dry, there was a small but definite increase in the net power input with a rise in the hardening temperature. The explanation given for the effect of the temperature upon the grinding ratio may also apply with respect to power. In wet grinding, however, there was no consistent effect of the hardening temperature upon the power. Although a reduction in the hardening temperature can affect both grindability and grinding heat favorably, the benefit is far too small to be of any practical significance, and the hardening temperature should continue to be selected solely on the basis of metallurgical considerations.

Table 2—Surface Grinding Test Results

Steel Type (AISI)	Grinding Ratio Regular	FM	Increase (percent)
	Dry Grinding		
M2	17	34	100
M3*	5.5	15.4	180
M4	2.8	9.5	240
D7	---	---	---
	Wet Grinding		
M2	6.4	9.6	50
M3*	2.7	4.2	60
M4	0.9	2.1	130
D7	0.9	3.1	240

*Type 1.

Form-Grinding Study

Relative grindability of the regular and free-machining varieties of M4 high-speed steel was also evaluated in a form-grinding test. This consisted

of grinding one or two grooves in the same test blocks with a fairly hard wheel shaped to a 60-degree V with a 0.030-inch flat to avoid a sharp corner that would break down immediately. An eight-inch diameter 32A60-L5VBE wheel was used for this test, which was run on the same machine used for the surface grinding test. Wheel speed was 6000 fpm and table speed was 450 ipm. Unit downfeed was 0.002 inch after each table traverse and total downfeed was 0.060 inch. Since the grooves were burned somewhat, the wheel was a little harder than would be recommended for grinding the same form in actual parts made of M4 steel, but this did not affect the interpretation of the results. The wheel was diamond dressed to the required shape for each run, which was made without breaking in the wheel by any preliminary grinding.

Grinding ratios were calculated from the change in wheel diameter and the depth of the groove resulting from a total downfeed of 0.060 inch. The material removed during a traverse of the block increased with each successive downfeed because the wheel face penetrated deeper into the work, but the wheel wear on the diameter was approximately the same for each traverse. As a result, the grinding ratio, calculated as the total volume of material removed divided by the total volume of wheel wear, increased approximately linearly with each successive downfeed. By always keeping the total downfeed constant, the grinding ratios for various test runs were directly comparable. Corner breakdown was ignored in the volumetric calculations since it did not significantly affect the relative values of the grinding ratios. Under the standard test conditions that were used, the grinding ratios were about twice as great as for the regular surface grinding test previously described, and a direct comparison between the grinding ratios in the two types of test should not be made.

Table 3—Effect of Hardening Temperature on Grindability

(M3 high-speed steel)

Temperature (degree F)	Dry Grinding		Wet Grinding	
	Regular	FM	Regular	FM
	Grinding Ratio			
2210	5.7	18.7	2.9	4.4
2240	5.5	15.4	2.7	4.2
2270	5.5	14.6	2.5	3.2
	Net Power Input*			
2210	8.7	8.3	10.8	10.3
2240	9.2	8.9	10.6	10.2
2270	10.2	9.2	10.7	9.4

*Arbitrary units.

Both a sulfurized grinding oil, such as is commonly used for thread grinding, and a water-base solution were used in this portion of the study. The latter was not a soluble-oil emulsion but a rich nitrite-amine solution originally developed for titanium grinding, containing 3.5 percent potassium nitrite. This same solution had also been used in additional surface-grinding tests similar to those reported in TABLES 2 and 3, and had in all cases resulted either in the same or in slightly higher grinding ratios than obtained with the soluble oil. Thus it is reasonable to assume that parallel form-grinding results would have been obtained with a conventional soluble-oil emulsion.

Grindability of the free-machining steel in the form-grinding test was higher than that of the regular steel, just as was found in the surface-grinding test. With the nitrite solution, the grinding ratio for regular steel was 9, as compared to a ratio of 22 for free-machining steel—a 140 percent increase. With grinding oil, the ratios were 19 and 27—a 40 percent increase. The percentage increase in grindability happened to be practically the same for form grinding as for surface grinding when a water-base grinding fluid was used. However, the increase was much smaller when a sulfurized grinding oil was used in the form-grinding test. Evidently the sulfur in the free-machining steel, while it did have some beneficial effect on the grindability, was much less effective when active sulfur was present in the grinding fluid. The grinding ratio was approximately the same for grinding the regular steel with the sulfurized oil as for grinding the free-machining variety with the nitrite solution. These results provide further evidence that the improved grindability of the free-machining high-vanadium steels is due directly to the addition of sulfur rather than to a microstructural change.

Conclusions

Addition of sulfur to high-vanadium tool steels to improve their machinability also improves their grindability in the hardened condition, even though experience has shown that their wear resistance remains the same. Grinding difficulty increases with vanadium content, other things being equal, but the improvement in grindability through sulfurization of the steels is greatest for those that are otherwise the most difficult to grind. The improvement is much more pronounced for dry grinding than for wet, and is least when a sulfurized grinding oil is used. Thus to the extent that the free-machining varieties of the low-grindability tool and die steels are suitable from the standpoint of the finished product, they can be advantageously used to reduce grinding costs.

Barrel Finishing
with specific-shape abrasive media

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Close-tolerance and delicate parts can be accurately and efficiently finished in modern barrel equipment, using shaped abrasive media. Charts developed by the authors make it possible to quickly select the best media sizes and types for finishing specific parts.

WITH THE SEARCH for ways to reduce manufacturing costs, barrel finishing processes have come into increasing prominence. These processes were once limited to rough deburring, but with the development of modern equipment and materials, barrel finishing has come of age as a precision process. One manufacturer of precision gears, for example, is barrel finishing gears that have production tolerances of five millionths of an inch. These tolerances are consistently held during the finishing operation and the cost of barrel finishing is a fraction of the cost of the manual finishing operations previously employed.

The barrel finishing process, as defined by the National Barrel Finishing Forum, is "The controlled processing of large or small parts in a rotating barrel containing media and/or compounds, for finishing operations such as descaling, rust removal, deburring, flash removal, degreasing, rust inhibiting, etc." Media are natural or artificial stones, loose abrasives or shaped abrasives. The purpose of media is to protect parts from contacting each other and to provide cutting or grinding action. Compounds include rust inhibitors, detergents or other water-soluble additives for cleaning parts and promoting finishing action. Water is added to the load in the barrel to cushion the movement of the load of parts and media and to carry particles of metal and abrasive away from the work.

Types of media, types of compound, ratio of media to parts, ratio of the volume of the load to the volume of the barrel and water level are all variables that can affect the efficiency of precision finishing operations. General rules for controlling these variables are given in THE TOOL ENGINEER, April, 1957, p. 109. The present article will cover the application of specific-shape abrasive media.

Media Sizes: Specific-shape media consist of abrasive grains molded with a bonding agent into triangular or cylindrical configurations. They are available in a wide range of sizes and lengths, and also with several different types of grains and bond materials. They are somewhat more efficient than random-shape media because they provide maximum surface contact with the work.

A triangle shape, for instance, is advantageous when deburring or chamfering holes, or when finishing parts with interior corners, *Fig.* 1. The corner of the triangle can penetrate into recesses but there is no danger of the media becoming lodged in a hole if a sufficiently large size is selected. A cylindrical shape, *Fig.* 2, is well adapted for finishing curved edges and round holes.

Specific-shape media, owing to their high abra-

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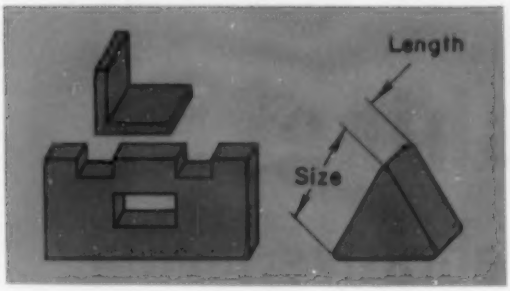


Fig. 1. Corners of triangular media can reach inner and outer corners of rectangular parts.

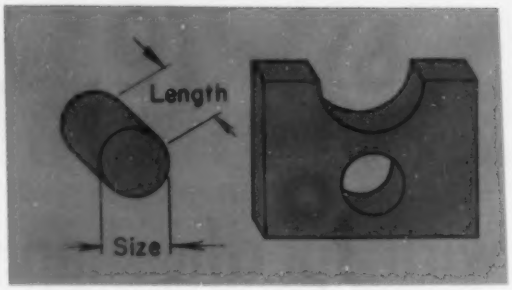


Fig. 2. Cylindrical media are especially effective for parts having large round holes or curved areas.

sive content and greater surface contact, cut faster than other media, shortening the finishing cycle. Because of the faster cutting action, there is no tendency toward peening or rolling over burrs; all burrs are cut off cleanly.

Media are classified according to "size" (length of side of triangle or diameter) and "length" (thickness of triangle or axial dimension of cylinder). The larger media sizes are used for rough cuts, hard materials and nonprecision work; the smaller sizes are used for finer cuts and precision work. The finishing action of large-sized media is violent, so small sizes are chosen for finishing fragile or delicate parts.

The chart shown as *Fig.* 3 is a guide for determining the best sizes and lengths of media for specific applications. When using the chart, these points should be kept in mind:

1. Is the workpiece likely to be damaged by violent action?
2. Is the workpiece material hard or soft?
3. Is the work precision or nonprecision?
4. Are there holes or slots where plugging is likely to occur?

Use of the chart can be illustrated by an example.

A small, fragile precision, stainless-steel part with a 1¾-inch square hole in the center, *Fig.* 4, is to be finished. Requirements call for deburring the edges of all the corners, including the square hole. Triangles appear to be the most effective shape because of the square hole. In order to pass through the hole, the size and length of the triangle selected must be less than 1¾ inches. Accordingly, maximum possible triangle size is 1½ x 1½ inches.

A triangle of this size will give a rough, fast cut. A ⅜ x ⅜-inch triangle will give the finest cut possible. Because of the fragility and precision nature of the part, it is necessary to use a small triangle, even though a fast cut is desired. Accordingly, a ¾ x ⅞-inch triangle is selected. This is the largest triangle of the "fragile work" group, as shown in the lower left-hand area of the chart.

Media Types: Specific-shape media are made in three types: those containing aluminum oxide grit only; those containing a blend of aluminum oxide and silicon carbide grit; and those containing sili-

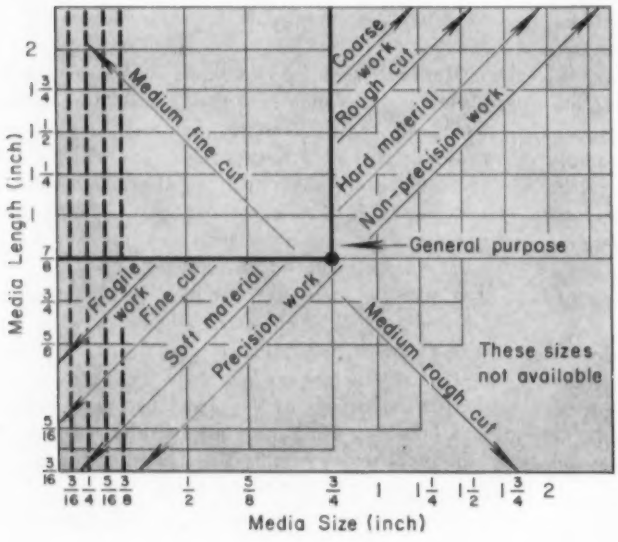


Fig. 3. Chart for determining best size and length of media for specific parts. Small media are used for fragile work, fine cutting, soft materials and precision work; larger media are for coarse work, rough cutting, hard materials and nonprecision work.

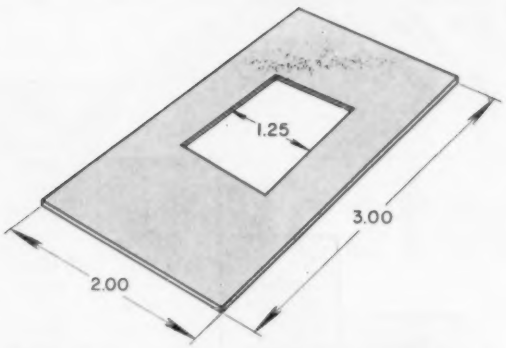


Fig. 4. Sample workpiece. Finishing operation is to deburr all exterior and interior corners. Material is stainless steel.

con carbide grit only. The aluminum oxide type is available with four grit size ranges: 60/120, 100/220, 100/320 and 240/320. The bonding material is hard, so aluminum oxide shapes are long-wearing and can be used for long cycles. This type of media cuts all metals efficiently and is considered best for general-purpose work.

The aluminum oxide-silicon carbide type is available with 36/80 and 46/150 grits. This media has a softer bond than the aluminum oxide media and wears down faster on heavy parts. However, it has long life on thin and delicate parts. On such parts, the finishing action is faster than that obtained with the aluminum oxide media. Performance on light steel, brass, aluminum and copper is excellent.

Media with silicon carbide grit (available in 38/80 and 100/200 grit sizes) have a softer bond than the media containing the aluminum oxide-silicon carbide blend and are intended for use on aluminum and copper, soft materials, and light parts. Deburring is exceptionally fast when finishing light metals and light parts but these media wear down quickly on heavy parts.

Available grit sizes and types are shown in *Fig.* 5. Since media with aluminum oxide grit combine long life and medium-fast cutting action, they are usually the best choice for finishing the average part. However, since the sample part is light in weight, a media with faster cutting action is preferable. The next choice would be media containing the aluminum oxide-silicon carbide blend. However, these media are available only in 36/80 and 46/150 grit sizes, which are intended for rough cutting. A fine-cutting media is required to obtain the necessary precision and finish on the sample part. Accordingly, media with silicon carbide grit are chosen. The 100/320 grit size will give the required finish and will cut faster than the 240/320 grit, so it is the final choice.

Amount of Media: Since media prevent parts from striking against each other, a high ratio of media to parts offers maximum protection to the work. The chart shown as *Fig.* 6 illustrates the recommended media-parts ratios for all classes of work. For extremely coarse work, a ratio of 0.5 to 1 (by weight) is satisfactory. A 1:1 ratio is satisfactory for slide honing equipment (in which individual barrels are mounted on a rotating faceplate). With conventional horizontal barrels, a ratio of 3 parts media to 1 part work is considered a good choice for general work. The ratio is as high as 16:1 for extremely fragile parts, using conventional barrel equipment.

Because the sample part is fragile, a high ratio of media to parts is required. For experimental purposes, a ratio of 4:1 is selected for slide honing

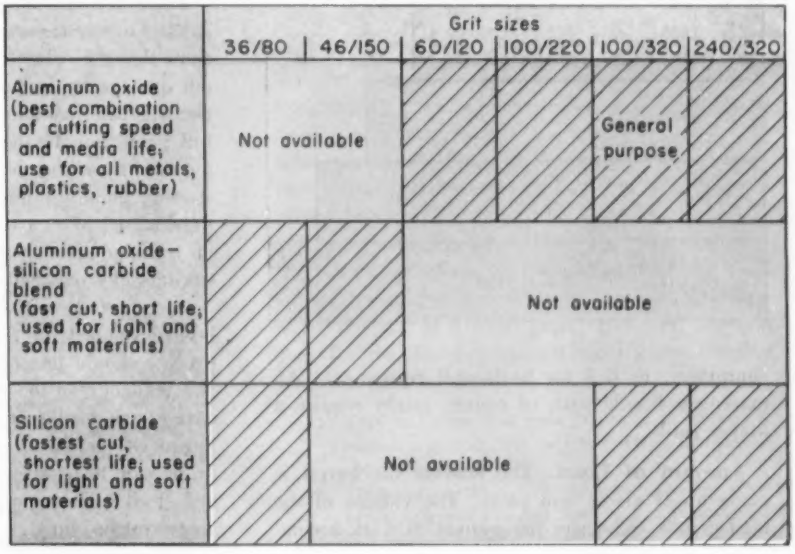


Fig. 5. Chart for selecting type of media. Media with coarse grits give fastest cutting action; fine grits give higher precision.

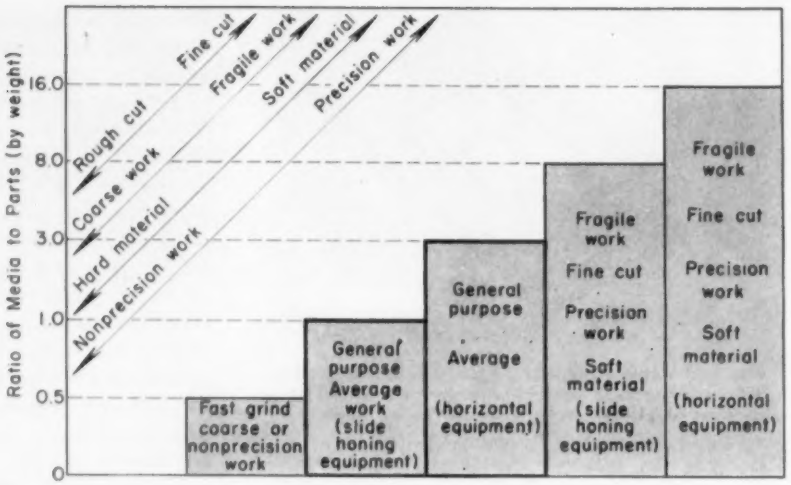
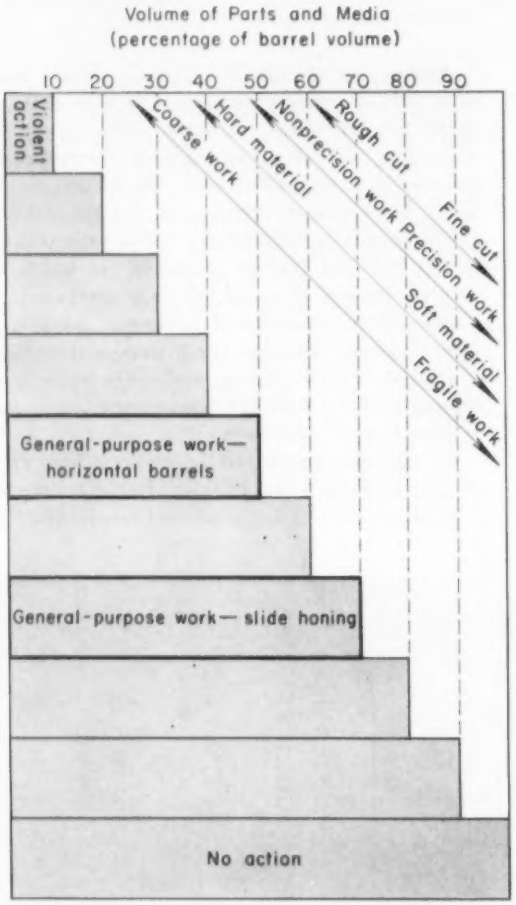


Fig. 6. Chart for determining ratio of media to parts. Low ratios are used for fast cutting and nonprecision work; high ratios result in slower cutting but give better precision.

Fig. 7. (below) Chart for determining volume of parts and media with respect to volume of finishing barrel. Low parts-media volumes result in fastest action; high volumes give greatest protection to parts and precision.



equipment, or 8:1 for horizontal equipment. An extremely fragile part, of course, might require a higher ratio.

Amount of Load: The load in the barrel is made up of media and parts. The volume of the load greatly influences the amount of work accomplished during the finishing cycle. When a barrel is filled to less than 50 percent of capacity, the action is violent and cutting is fast. Because of this violent action, there is a strong possibility of parts striking one another, with consequent damage to fragile parts. As shown in *Fig.* 7, barrel loads can range from 10 percent of barrel volume for coarse work to slightly higher than 90 percent of barrel volume. When a barrel is completely filled with media and parts, no finishing action can take place.

Since the sample part is considered to be fragile, the volume of parts should be at least 50 percent of barrel volume for slide honing and 70 percent of barrel volume for horizontal equipment. The high limit is, of course, 100 percent. For experimental purposes, a percentage half way between minimum and maximum is usually selected. This is 75 percent for slide honing equipment and 85 percent for horizontal barrels.

These volumes will usually give satisfactory results. Further experiments on the sample part may show that the volume of parts can be reduced without damage to the part, or it may be necessary to use a greater volume of parts and media to give full protection to the parts. The data given, like the data shown in the other charts, furnish a good starting point for developing suitable methods for finishing a given part. Such data enable the amount of trial-and-error experimentation involved to be substantially reduced.

Once a fully satisfactory finishing process has been developed for a part, no deviations from the process should be permitted in production. There is a tendency on the part of some operators to use coarser-grit media or reduce the media-work ratio in order to get faster cutting action. This can result in damage to parts or inferior finishes. Close control of all variables during production is the key to successful finishing.

Indicator Gages improve quality

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Fig. 1. Work-in-process inspection of parts at the machine station. Operator performs sample inspection at given intervals and records data on analysis forms.

Production demands for closer control of tolerances require selection of the proper gages. The author outlines the advantages of indicator gages with emphasis on examples of successful applications of these tools.

CAREFUL PLANNING is necessary if adequate control of quality of purchased material, work-in-process and finished products is desired in a mass-production industry. An important phase of this planning is the design and application of a suitable gaging system.

Many quality control problems were encountered during development and setting up of a program for the production of a new adjustable razor. Because large quantities of parts are involved, the gages must give accurate estimates of product quality by inspecting small quantities of production. In addition, gages had to be designed for use by unskilled personnel, *Fig.* 1. These conditions require that the gages be simple to use, positive in location, easy to read and easy to set up. Use of statistical quality control techniques was a major consideration since improper application would increase inspection costs and reduce the efficiency of the operation.

Fixed inspection gages were not considered for the job except where no other gage could be used. Occasionally, the economics of the situation require the use of a fixed gage. However, the reasons for the decision against fixed gages for this program are:

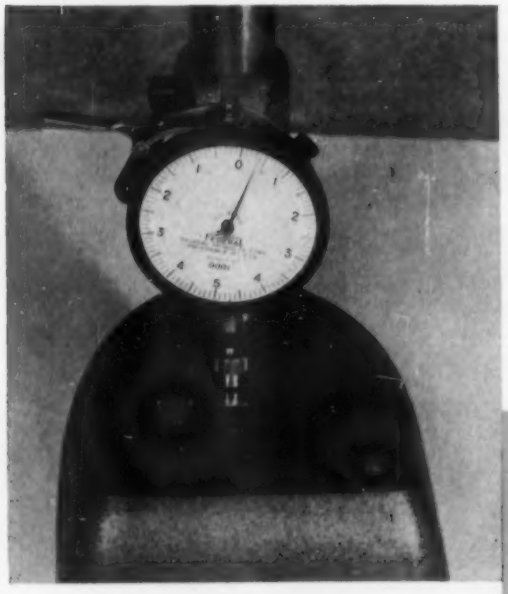
1. They tell only if a piece is inside or outside of tolerance so that little information can be obtained about the process
2. They require the use of attribute sampling plans, which call for a larger sample size than usually necessary in variable sampling plans

3. They wear faster and require more attention from the gage control department
4. They cannot be easily adjusted to changes in tolerance and specification.

For the inspection operations on the new program, indicator type gages were selected so that actual sizes could be determined on every possible dimension. Knowing the sizes permits better process control by helping the manufacturing department set up machines on the nominal dimensions, thus taking advantage of the available tolerances. Another use of the data during manufacturing is to provide for compensation due to tool wear. As the tools wear through use, the machines can be reset to maintain size when wear patterns can be predicted. With actual sizes, process control charts can be easily made during the sampling inspection.

Indicator gages make it possible to:

1. Use a variable type of statistical sampling plan at incoming materials inspection, permitting evaluation of shipments with a minimum sample size
2. Gather more useful data than is possible from fixed type gages when experimental lots of material are being produced
3. Trouble-shoot difficulties because the data obtained can be easily analyzed.

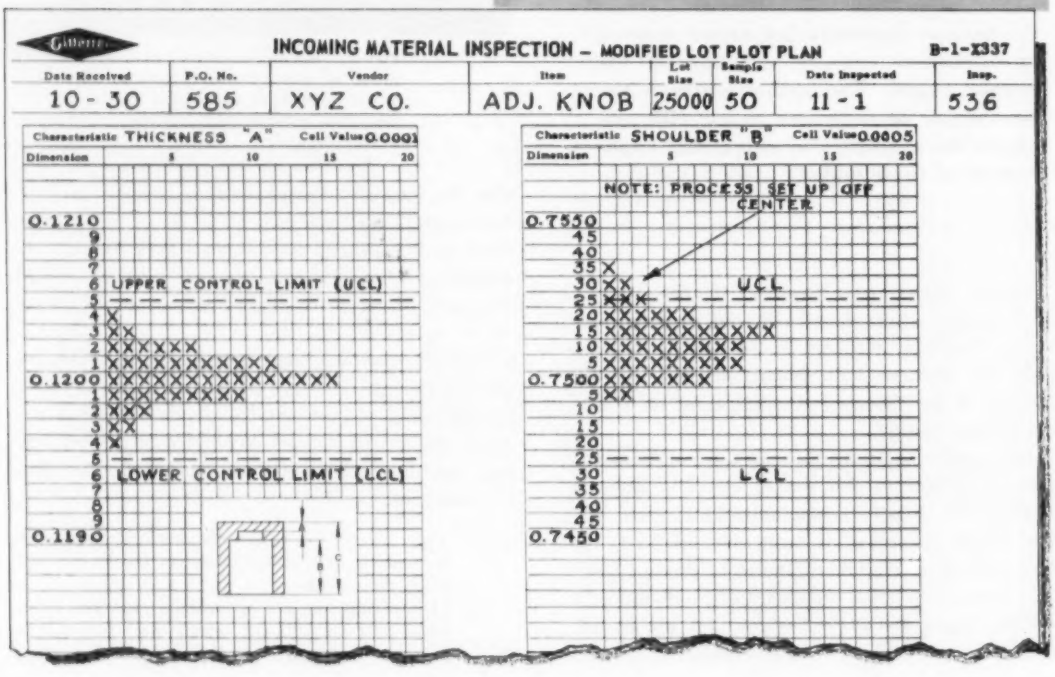


Indicating gages of the simplest type have a reference anvil and set-block gage mounted on an indicator stand. Such a gage can measure the thickness, the shoulder distance and the over-all length of a part being checked as shown in *Fig.* 2.

The anvil facilitates setting the indicator to zero from a standard reference pin built into the anvil. Other location pins are dimensioned so that this

Fig. 2. (left) Indicator gage having a reference anvil and set block with part in gaging position.

Fig. 3. Analysis form used with a gage records the dimensions designated in the part cross section. A sample of 50 pieces is taken from a lot at incoming receiving inspection.



setting applies for the three part dimensions shown on the drawing, *Fig.* 3. The gage, *Fig.* 2, is set from the pin on the right. The inspector, after setting the gage, checks the thickness by placing the part on the left-hand pin. Then, the shoulder distance is checked on the center pin and the over-all length is measured on the right-hand pin. This third pin also serves as the standard reference.

Results obtained from this inspection are charted on the form shown in *Fig.* 3. Data presented in this manner inform the inspection supervisor more about the parts being inspected than if a go and not-go gage were used. In addition, the data can be analyzed statistically to determine the percentage of parts outside of limits and the extremes of dimensions being encountered. The possibility of measuring more than one dimension in a setup should always be considered. Generally, measuring multiple dimensions depends on the part to be measured and the ingenuity of the gage designer.

Indicating internal and external thread gages are used because speed of measurement is increased and gage wear is less than with other available gages. On most parts, it is necessary to measure the runout of a shoulder or diameter from the pitch diameter of a thread and concentricity to an inside diameter, as shown in *Fig.* 4. The piece is inserted in the gage and the pitch diameter noted on one of the indicators. By turning the piece, the inspector then measures the runout of the inside

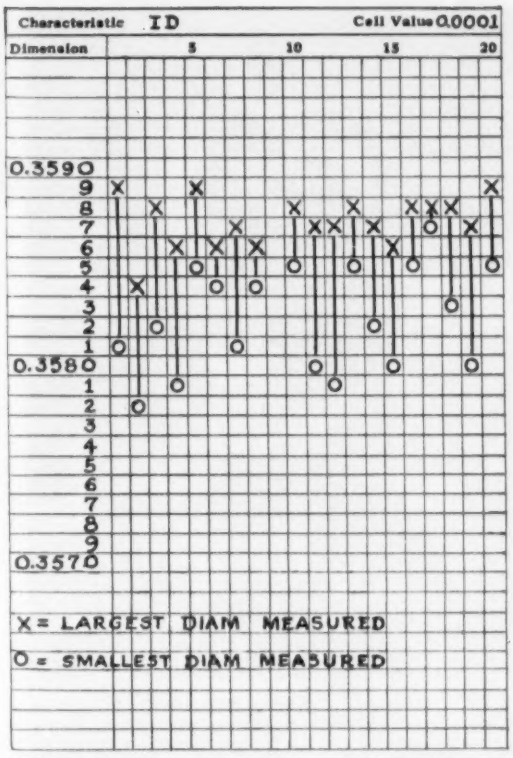


Fig. 5. Chart for recording the out-of-roundness and diameter of a hole. The symbol *X* shows the largest diameter and the symbol *O* shows the smallest diameter found in each hole measured.

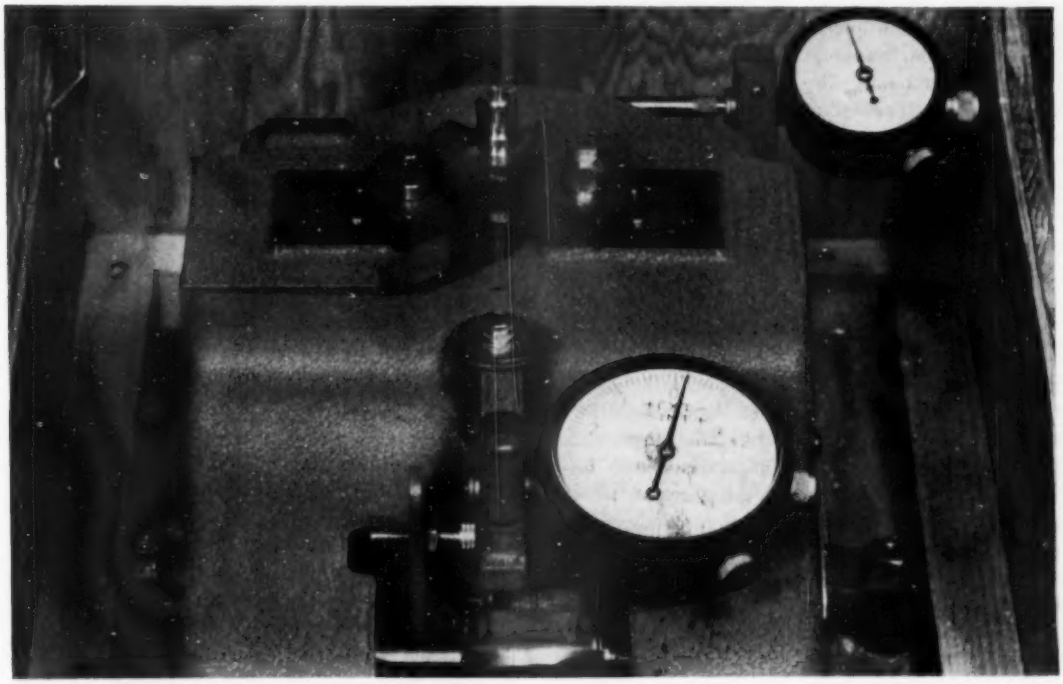


Fig. 4. Thread gage with indicators checks the pitch diameter of the thread and concentricity of the hole relative to the thread. Gages are kept in carrying cases to protect the unit and improve portability.

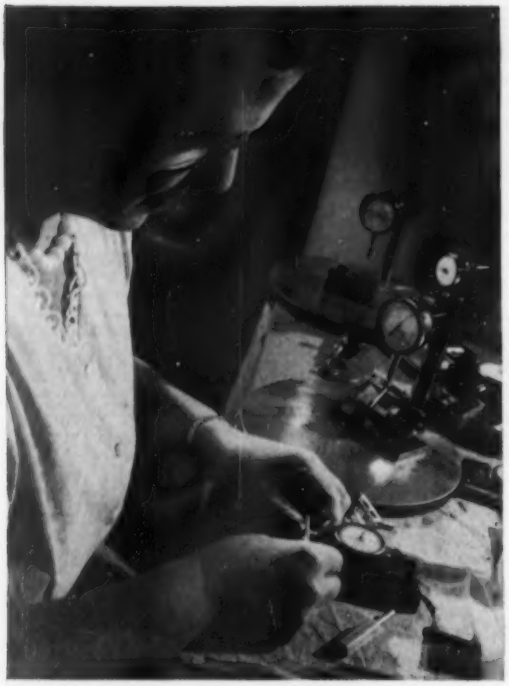


Fig. 6. Inspection station where parts are being checked to a lot-by-lot acceptance gaging plan. All the gaging equipment needed for the operation is located at the worktable.

diameter with the pitch diameter of the thread and records the dimensions for analysis.

Wherever the tolerance is less than ±0.002 inch, dial indicator plug gages are used to show out-of-roundness, bell-mouth and taper conditions. These plug gages are also valuable as an aid in setting up machines properly since they do not wear as fast as standard plug gages. *Fig.* 5 shows how the multivari chart can be used with such a gage. Here, the variations in the average size of the parts are measured as well as out-of-roundness conditions.

Fig. 6 shows a typical group of gages set up to measure a specific part in the purchased material inspection area. The inspector sits at a bench and inspects random samples of fifty pieces of the parts. Written instructions which specify the gages to be used and the dimensions to be measured for each set of samples are located at the inspection bench. The inspector records all measurements on charts similar to *Fig.* 3. These data are sent to a quality control clerk for calculation of the percentage of material outside of limits on each dimension measured. The inspection supervisor is informed and the decision is made to accept or reject the material. This is an example of lot-by-lot acceptance of material as received from a vendor. The variable gaging allows use of a smaller sample to evaluate quality and gives a clear picture of the distribution of measurements of each dimension on the part measured.

In-process control of product at the machine station is shown in *Fig.* 1. Inspection benches are located close to the machines making the parts. All the gages necessary to inspect the part are located on these benches together with the inspection instructions and the charts on which the operator records results. The inspector makes a routine trip through the department at specified intervals and sample checks parts from each operation. Whenever results indicate that an adjustment is necessary, the process can be corrected before defective material is manufactured. If, however, any defective material has been made since the last check, the parts are sampled to determine if they must be screened for defectives.

Consideration of the quality control procedures available is important when planning a gaging program for large-quantity production. It is advantageous to make the gaging system adaptable to changes in tolerances and inspection procedure wherever possible. All functional dimensions, that is, those dimensions which affect customer satisfaction and are necessary to reduce rejection of completed units at assembly, should be checked. If a dimension is important enough to measure, the best possible gaging should be supplied to do it and a record should be made of the results.

The initial cost for indicator gaging is higher than it would be for fixed gaging. However, indicator gages afford the opportunity to measure in terms of finite units. It is possible to learn and to know more about the product and the processes used to produce it. As a result, investigation, correction and improvement of quality are facilitated. Inspection is faster, more economical and more reliable than that provided by fixed gages. These advantages far outweigh the cost differential where high production rates are involved.

The aim of any gaging program is to provide the necessary inspection to maintain high quality at minimum cost. To do this, the performance of machines, processes and people must be evaluated in the most accurate manner available. Inspection gaging routines which allow this analysis play an important part in improving the product.

CORRECTION: In the article, "Improving Punchability of Silicon Steel" by C. S. Wukusick and R. S. Zeno in the December issue, an unfortunate error appeared in the footnote to TABLE 3. It should have read, "Clearance with-grain = 0.0015 inch, cross-grain = 0.0020 inch. For Test 15, clearance = 0.0021 inch for each side." Also, in TABLE 1, Sterling pickled should have read Mill pickled. We are sorry for the errors and hope this correction notice will be seen by those interested in the article.—ED.

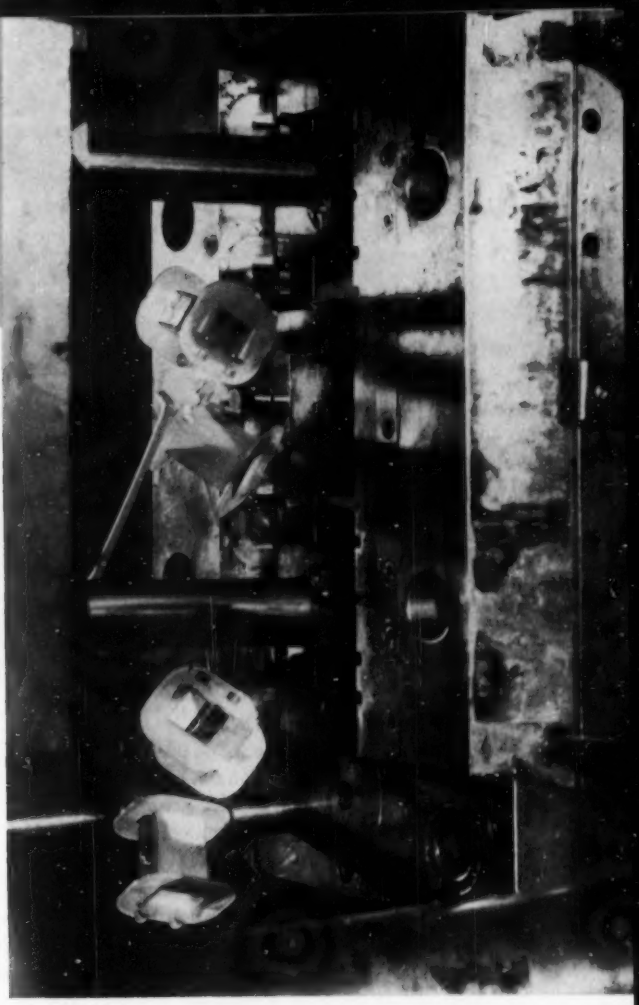


Fig. 1. Automatically injection molded nylon spools are ejected from the mold after being selfdegated from the runners.

Automatic Injection Molding

By Judson H. Downing
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Meter Dept.
General Electric Co.
Somersworth, N. H.

Complex nylon parts are being produced automatically in several plants. This type of tooling greatly increases productivity and, if properly designed and maintained, results in improved product quality and reduced costs.

RECENT ENGINEERING ADVANCES in mold design and injection molding equipment, as well as better auxiliary equipment and improved materials, have made it feasible to mold complicated nylon parts automatically. Close tolerances can be held well within limits normally obtained only with close supervision and control of production.

An example of a complex part which is being molded automatically, is a nylon potential spool which has undercut side surfaces in addition to irregularly shaped top and bottom surfaces with core holes in three planes. Such parts, used in watt-hour meters, have brought about considerable cost reduction and quality improvement. A four-cavity, double-side action, cam-actuated split-cavity mold is used, *Fig.* 1. The mold is tunnel-gated to self degate the parts and runners during ejection.

Planning: The most important factor in the success of automatic molding is careful planning. It should be kept in mind that not all parts lend themselves to automatic molding. If a part is suitable for automatic molding, the equipment, tools and methods should be studied. Once it has been determined that investment costs can be justified, the plastics planner should analyze the part in detail before the design is "frozen." Whenever possible, a model should be built, so that careful consideration of the product can be given. Time-consuming errors in mold making and production can be avoided by following this procedure. Also, valuable suggestions for improved functional design and ease in molding are often revealed.

Mold design and product design are closely linked together. During the planning period product

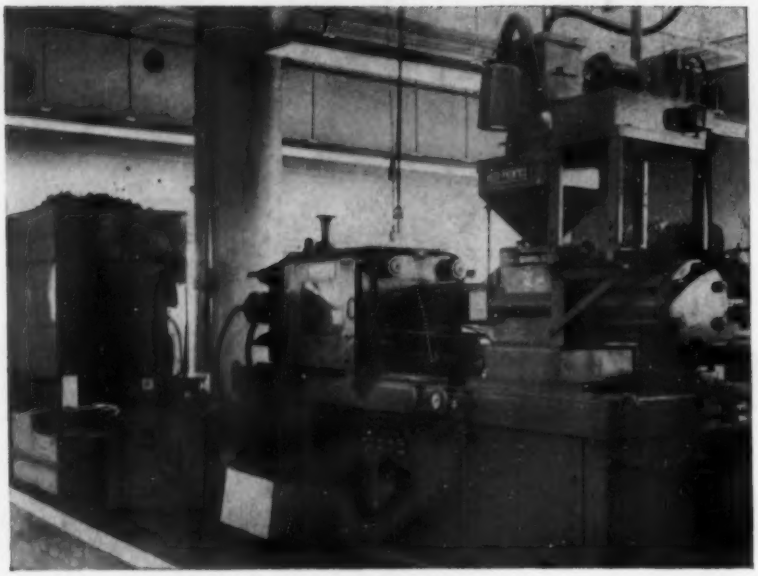


Fig. 2. Automatic molding machine and support equipment for molding plastics potential spools. Auxiliaries include: drying oven, hopper dryer, hopper loader, mold temperature controller, grinder and mold loading hoist.

draftsmen, product engineers, plastics planners, tool builders and molders should work together. Such cooperation enables the product to be practical from economical and functional standpoints.

Equipment: Once the product design is determined, the next step is selection of equipment and tools. The injection press, *Fig.* 2, should have adequate plasticizing capacity, the proper range and distribution of heat within the cylinder and three proportioning type controllers to maintain cylinder temperatures accurately. The injection press should also have:

1. Low pressure closing for mold protection
2. High injection pressures (20,000 psi)
3. Fast rate of injection
4. Timers for controlling cycle elements such as "plunger forward," "booster on," "dies close," "dies open"
5. Reverse taper design nozzle with pyrometer control
6. Adequate clamping pressures
7. Automatic heater shutoff when press stops on automatic cycle
8. Warning horn to signal that the press has stopped while set on automatic cycle
9. Adjustable feed control.

Some of the auxiliary equipment necessary is a drying oven, a hopper dryer, a hopper loader, a mold temperature controller, a grinder and a mold loading hoist. The purpose of the drying oven and hopper dryer is to keep the moisture content of the granular material to a minimum before molding. It has been found that excess moisture will result in interruptions in automatic operations, caused by drooling at the nozzle. Also, it may cause splay marks on the surface of moldings, excessive flash, reduced toughness, porosity and poor control of dimensions. The molding powder is placed in trays to a depth of approximately one inch, and dried to a minimum moisture content of 0.25 percent in a circulating oven at a temperature of approximately 185 F. Equipment is available for readily checking moisture content.

The hopper loader helps to keep atmospheric moisture from the material, as well as providing a fast and easy way of loading the hopper without a high loading platform. The mold temperature controller is essential in order to hold even distribution of heat in the molds. Usually mold temperature should be kept around 100 F to 145 F for normal operation. Lower temperatures are used when extreme toughness in thin sections is desired. High mold temperature will not usually help appreciably and may impair the toughness of the molded part. The grinder is used to cut up the runners and sprues to granular form for re-use. It is good practice to use uniform proportions of virgin material to reground material. It is necessary to dry reground material in the same manner as virgin material. Generally, longer drying periods are required for reground material, because the material is usually exposed to atmosphere moisture for long periods as it is being accumulated. Blending the material uniformly is important in an automatic operation because uniform plasticizing is necessary.

Molds: Not every application will merit the usual 15 to 25 percent higher mold costs for an automatic operation. Production must be high enough so that the tooling cost per unit will be low. Generally there are many approaches to mold design for fully automatic injecting molding. The design is determined to a great extent by the molding equipment and the material to be molded.

Sub-gating of molds for automatic degating or stripping of the parts from the runner system during ejection functions satisfactorily and results in considerable labor savings. Sub-gating helps to eliminate finishing operations, such as separating parts and runners, hand trimming and finishing rough surfaces. Usually sub-gated molds cost 5 to 10 percent more to build than similar molds with conventional gating.

Dimensional accuracy of molded parts depends to a great extent on the accuracy of the mold cavity. Mold cavities for parts which do not require close tolerances can usually be designed by using accumulated data from past experience or by using standard shrinkage allowances. When close tolerances are required, a single-cavity trial mold should be built and installed in the mold base which is to be used for production. The shrinkage data obtained will usually make it possible to satisfactorily adjust the dimensions for the production mold cavities. No matter how carefully all factors have been weighed experience has proved that single-cavity trial molds merit being built where close tolerances are needed. When parts are to be moisture conditioned or stress relieved the product dimensional changes that take place during these processes must also be compensated for in the cavity dimensions.

Automatic molds should be made of the best mold steels and should be hardened and polished. Chrome plating of mold surfaces is not usually necessary, although it may be desirable for maintenance of finish or when good release is necessary, as on long cores that have little draft.

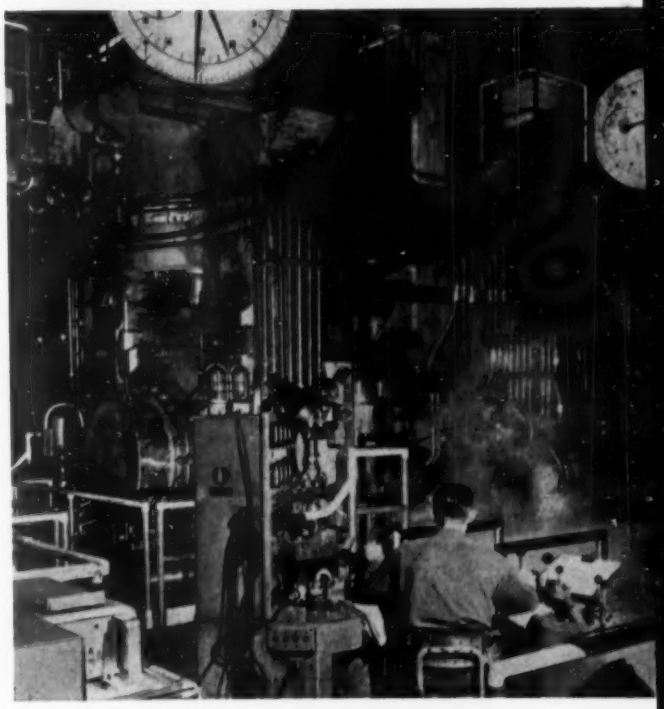
Both the design and the construction of automatic molds require a high degree of skill and experience. Success or failure of an automatic operation will be determined by the workmanship that goes into the mold.

It should be pointed out that automatic molding may not be the best choice for all applications. Some of its advantages are lower labor costs, savings in material, increased productivity and improved quality. Better inventory control and lower mold maintenance costs are added advantages. Disadvantages are higher initial mold costs (usually about 20 percent), the longer period required for mold development and construction and the need for highly skilled mold builders and maintenance personnel. Lack of operator inspection of each part as it is ejected from the machine can also be a disadvantage. However, automatic molding has resulted in impressive savings in many plants.

Punched Cards Guide Automated Rolling Mill

AN ELECTRONICALLY CONTROLLED rolling mill is working aluminum billets into slabs at Aluminum Co. of America. Following instructions on IBM punched cards, the automatic system establishes mill speed and roll opening for a 160-inch reversing mill at the Davenport works. The breakdown mill rolls 16-inch thick billets into slabs 3 to 4 inches thick. As a result of using the accurate, transistorized units, rolling operations have been simplified, and efficiency and production increased.

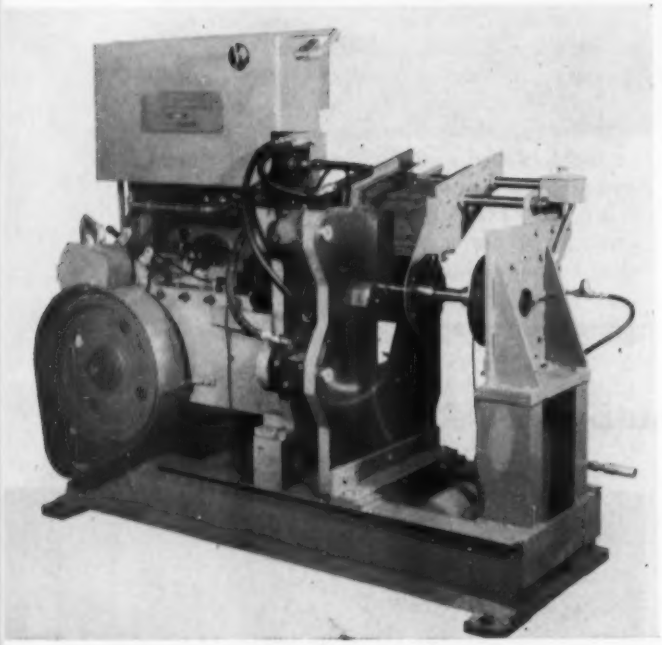
With the Prodac, Westinghouse Electric Corp.'s card-programmed system, automatically controls screw-down operation to establish distance between rolls as well as the smaller settings required for each pass. A single punched card containing mill speed and roll setting for each pass in the rolling scheduled is placed in a card reading unit. With press of the start button, the reader translates the information into electrical impulses that order the screw-down to position rolls for the initial pass. Simultaneously, the reader sets mill speed and indicates mill direction and pass number to the operator who completes the pass manually. The procedure is repeated until the signal flashes that the final pass has been completed. Then the next billet can be positioned.



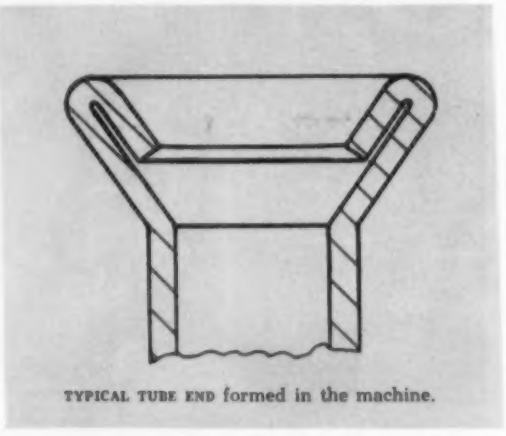
designed for

PRODUCTION

Tube Ends Formed Automatically



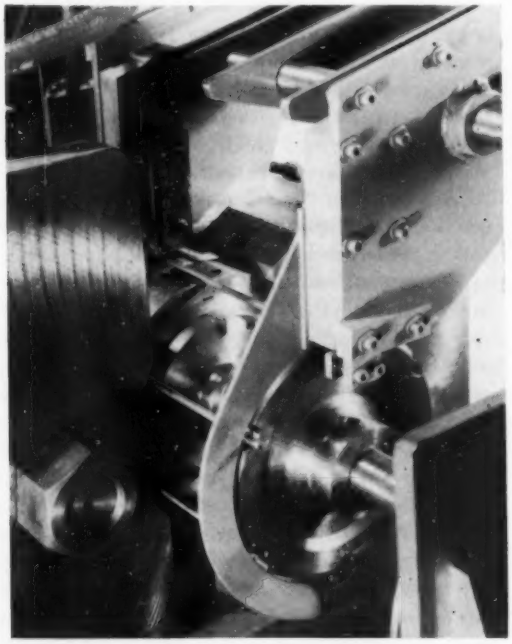
MACHINE flares tube ends automatically. Chute at the rear of the machine feeds the loading station of the fixture.



TYPICAL TUBE END formed in the machine.

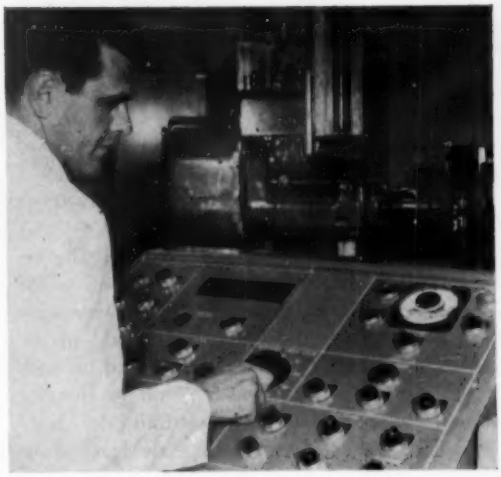
Production of flares on tubing ends has been facilitated with the development of an automatic machine by The Vaill Engineering Co. Tubes are chute fed into a rotating drum fixture. They are held in position during forming by air-hydraulic clamps and are gravity-dropped from the fixture.

Positive index of the drum fixture is obtained from the mechanically operated Geneva unit. Another design feature includes the use of a standard machine frame for the punch drive. By changing locating blocks and clamps in the fixture and punches in the head, the machine can flare tubes ranging in size from $\frac{1}{8}$ to $\frac{3}{4}$ inch at the rate of 3600 pieces per hour.



LOADING STATION of the drum fixture with one tube in first position. Tubes have been removed from the chute to show clamp construction.

Feed Rate Control Overrides Programming Tape



Reduction of tool loading in critical areas on a tape control system usually requires the remaking of the machine control tape. To eliminate the necessity of this tape rework, a manual control is built into the numerical control system produced by the Industrial Controls Section of Bendix Aviation Corp. This permits an override of the programmed feed rate.

Feed rate override may be exercised at any time during the machining cycle without affecting the accuracy of the finished part. As shown in the illustration, the operator can reduce the feed rate from the programmed rate, or 100 percent, down to as little as 20 percent of the feed on the tape.

Abbreviated Flux Cone Welds in Tight Places



Faced with the problem of making many ¾-inch fillet welds, a fabricating shop decided to use a semiautomatic submerged-arc welding unit manufactured by The Lincoln Electric Co. When it was discovered that the welding cone was too long for the confined working area, a worker promptly cut off the top of the cone. It worked well and the fabricator gained the speed and the quality of submerged-arc welding.

The part being welded is an iron ladle for an open-hearth furnace. The vertical plate shown on the left is two inches thick and the vertical section on the riht is a 12-inch thick slab. Horizontal ribs are 1½ inches thick and are beveled on both sides. Total length of weld around the ribs is three feet, with six passes needed to fill the beveled joint and form the fillet.

Low-Cost Magnetic Tape Control System

Application of tape-controlled machine tools to industrial problems has been limited by the large initial investment required. An economical system for the automatic control of these tools has been developed by Micro-Path, Inc., a subsidiary of Topp Industries, Inc. It uses magnetic tape to store a prerecorded program of directions to the machine which will produce the part.

The system is dual-purpose since the machine on which the unit is installed can also be used as the programmer. For continuous path programming a stylus and special head are used in place of the usual cutter. Positional control is supplied for each controlled axis of the machine to permit the operator to direct slide movement and to set feed rate.

Programming can be made directly from drawings or rough sketches. The stylus either follows the lines directly for recording position or is located by a positioning dial. When the latter system is used, hole locations, routing designs, circle centers and radii are given in numerical form to the nearest 0.0001 inch. Since the stylus follows the part contour, cutter offset is programmed directly on the tape so no other compensation for this factor need be made.

Medium for the recorded information is an 11-channel, three-quarter inch wide magnetic tape. Eight channels store motion information in each direction for each axis; one channel controls internal auxiliary functions; one channel controls external auxiliary; and one channel contains execute commands for the auxiliary functions.

TYPICAL SPECIAL MACHINE developed with the Micro-Path components. This bank of eight vertical drilling heads, using the numerical positioning control, produces check cancelling dies in a fraction of the time formerly required by manual operations.

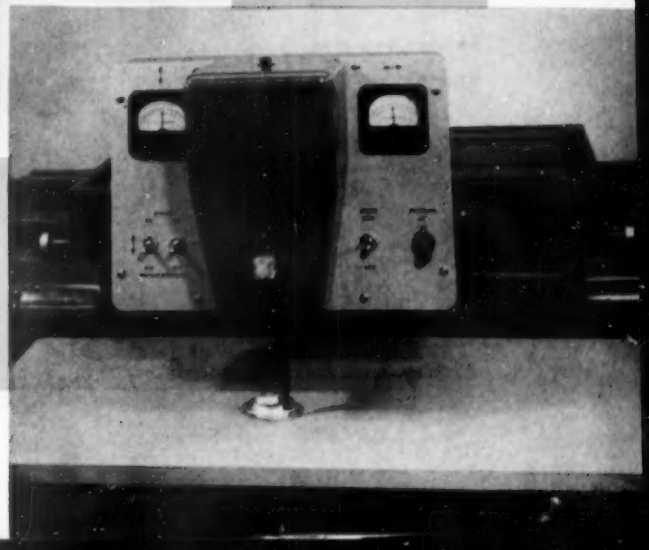




PULSE SERVO POWER UNIT of the reproduction system converts electrical impulses into rotary motion. Motion is synchronized with commands since the system has a capability of handling 6000 discrete steps per second.

CONTOUR TABLE and console (below) designed for continuous path milling, controlled from magnetic tape. The unit is self-contained and is used either on a vertical spindle machine or as the basis for a special unit.





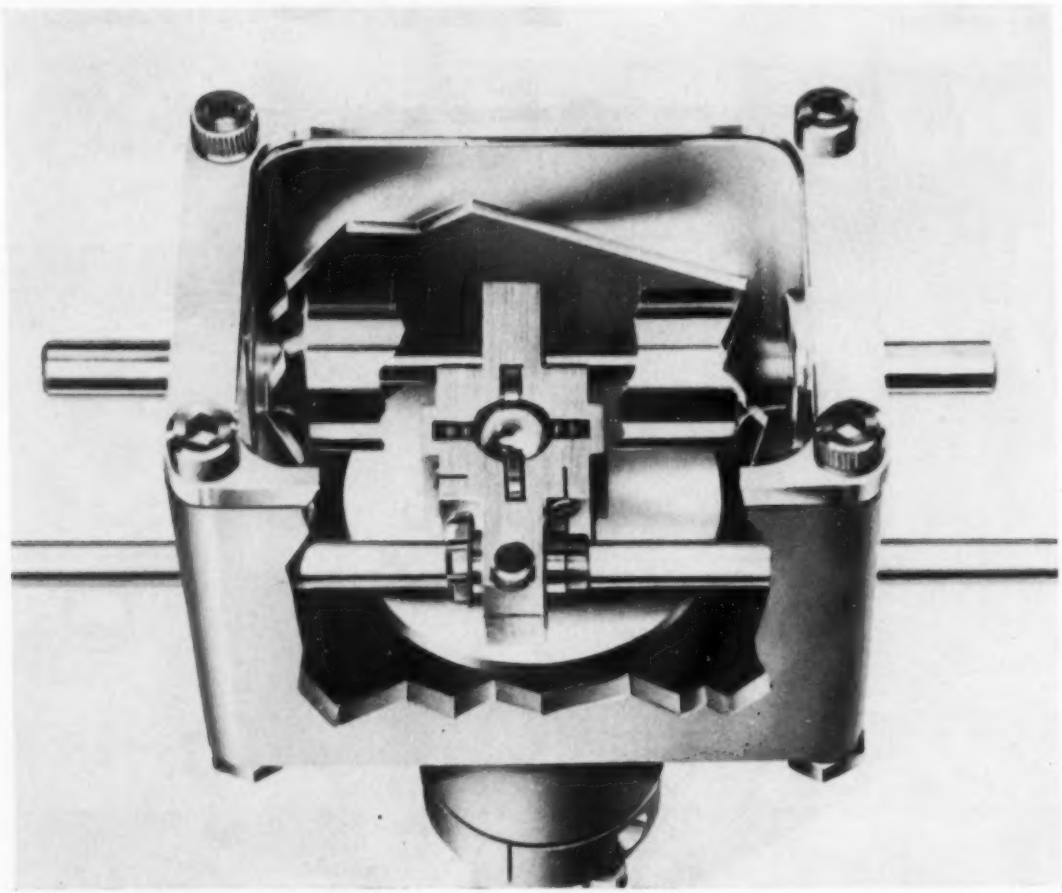
STYLUS PROGRAMMER (inset) for converting contours of a part or model into pulses for magnetic tape recording. As the table is moved, the stylus contacts the workpiece and the location of table is simultaneously recorded on the proper magnetic tape channels.

Integrator Design Reduces Friction

New design of a ball-disk linear integrator extends its life and improves its accuracy. The new ball carriage, designed by Librascope, Inc., reduces friction losses to less than 0.3 inch-ounce. Accuracy is literally adjusted-in, removing dependence upon production machining techniques to compensate for minor variations.

The new integrator is useful for a wide variety of mathematical functions such as rate determination and differential analysis. Its basic function is the integration of a variable with a constant, such as time, to provide a proportionately integrated mechanical output, which may then be translated into analog or digital signals for subsequent use.

There are three moving elements in the integrator as shown in the cutaway. During operation, a rotating tungsten carbide disk is driven at a constant speed to provide the factor of time. A pair of precision steel balls, supported in the special microbearing carriage, is driven by the rotating disk. These balls enter the factor to be integrated by their variable position along the radius of the disk. A rotating cylinder is driven by the balls to provide integrated output. The balls are held in firm contact with the disk and cylinder by a spring. Precision of the entire device permits a 0.10 percent reproducibility.

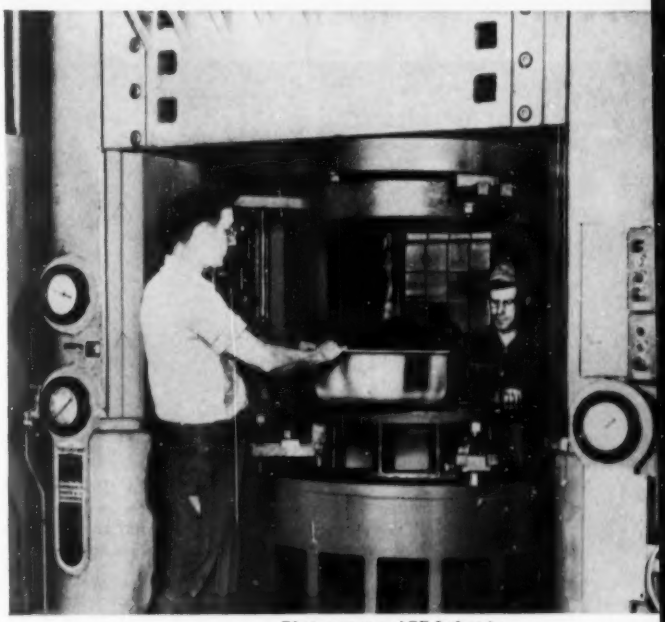


fabricating STAINLESS STEEL

part two—forming

By Richard E. Paret
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Forming stainless steels requires special techniques to compensate for high strength and resistance to flow. The author sets forth guides for product and tool design for efficient forming processes on each class of stainless steel. This article is the second in a series covering all fabrication methods.



—Photo courtesy ACF Industries

Fig. 1. First draw on this Type 302 stainless steel industrial mixing bowl reduces 31½ inch diameter blank to 20 inches. The second draw completes the bowl to finished dimensions of 14½ inches in diameter and 13 inches deep. Both draws are made on a 1000-ton hydraulic press.

WHEN FORMING STAINLESS STEEL, the various types must be handled in accordance with proved methods to cope with individual mechanical and physical properties. Chromium-nickel steels, for example have excellent ductility but work-harden rapidly. Straight-chromium steels are generally suitable for forming, but have somewhat less ductility at low temperatures. Procedures usually used with mild steel for blank preparation, die design and clearances must be modified for best results.

When planning or laying out a job, it is important to remember that, as with all mill-rolled steels, stainless steel sheet and strip stock have a prime and reverse side. The prime side can be more easily finished and polished after fabrication. With coil stock, the prime side is always on the outside of the coil, while reverse side of sheet stock always bears the inspection stamp.

Drawing: The combination of high tensile strength, low yield strength and good ductility of the austenitic grades provides good deep-drawing qualities. Exceptions are Types 201 and 301, which have extremely high work-hardening rates; Types 303 and 303Se have sulfur and selenium additions that lower formability and Types 308, 309, 310 and 314 are slightly more difficult to draw because of higher alloy content. Type 305 has the lowest work-

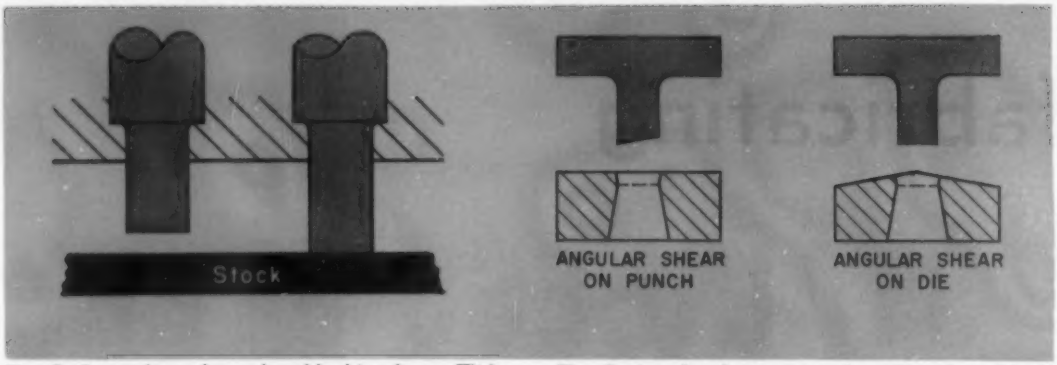


Fig. 2. Stepped punches reduce blanking force. With the arrangement shown, blanking force is reduced by 50 percent. Steps are about one-half stock thickness.

Fig. 3. Angular shear on punch or die reduces blanking force since only a part of the tool is cutting at one time. Relief may be ground on either member.



—Photo courtesy J. D. Ferry Co., Inc.

Fig. 4. Cutting 22 gage Type 430 stainless steel sheet on a shear. Layers of cardboard are used to protect finish. Blades must be kept sharp with good lip clearance and close adjustment.



Fig. 5. Circular shearing operation on Type 304 stainless steel plate to be used in the manufacture of refining vessels. Higher power is required for shearing operations on stainless than for carbon steel.

hardening rate of the austenitic steels and is excellent for deep drawing.

Frequently, draws of 50 to 55 percent are successfully attained with suitable types of austenitic steel. Generally, however, reductions of approximately 40 percent are made in initial draws, with 20 to 25 per cent reductions for subsequent draws, *Fig.* 1. These amounts are influenced by the design of the die, blank sizes, and the gage and type of material. The lower ductility and hardness of ferritic and martensitic steels restrict first draw reductions to approximately 20 to 25 percent of blank size. Ferritic steels become more ductile and more easily formed if heated to about 200-300 F. Immersing blanks in boiling water is a simple method for reaching this temperature.

The high strength of stainless steel and work-hardening tendencies of the austenitic grades present special problems. Presses require approximately twice the power used for mild steels, and reduced speeds—about 30 fpm—must be employed. Annealing may be necessary after severe drawing operations to relieve stresses and prevent cracking.

Blank Sizes: Experimentation is necessary to determine best blank size. Light draws with rounded tools slightly decrease surface areas, while heavy draws with sharp tools increase or stretch surface areas. Trimming allowance should range from $\frac{1}{8}$ to $\frac{1}{2}$ inch to allow for inaccuracies and uneven hold-down pressures. Larger trimming allowances also help to decrease wrinkling as the part is drawn into the die. When part design does not include flanges wide enough to serve for holding, extra material must be allowed and trimmed later.

Burrs on austenitic stainless steel blanks are usual-

ly work-hardened and must be removed. They can cause serious damage to dies, reduce hold-down pressures and cause slippage and wrinkling. Large burrs are preferably removed by high-speed grinding which promotes some annealing of the edges. Occasionally, small burrs can be leveled by running blanks through a rolling mill.

Die Design: Solid dies, of high-carbon, high-chromium tool steel provide excellent hardness and wear resistance. They should be highly polished and honed to prevent metal pickup. Stoning dies in the direction of metal flow will help to reduce seizing tendencies. Clearances between punch and die should range up to twice those used for mild steel, depending upon the material. Where possible, die radius should be not less than approximately five times metal thickness. A die radius of ten or more times the thickness of the stock, however, may cause wrinkling. Increasing holding pressure with spring-loaded hold-down pads will help to prevent wrinkling, but will lower maximum reduction.

Draw rings are generally made of hard, cast bronze and should be polished and buffed. Ejection of the part from the draw ring is preferable, and can be done by the last action of a triple-action press, or by any conventional spring pad ejection or stripping method.

Lubrication and Cleaning: Lubricants with either an oil or animal fat base, highly sulfurized, should be applied liberally before placing a blank in a drawing die. Water soluable oils are effective with shallow draws. Brushing, spraying, or rolling methods can be used to coat the blanks. All traces of organic matter must be removed from parts before annealing to prevent surface carburization and lowered corrosion resistance. Oil base lubricants can be removed with kerosene, followed by an alkaline cleaner.

Blanking and Punching: The depth of punch penetration to produce ultimate fracture and separation of blanks from stainless steel strip must be carefully adjusted. Straight chromium steels break, or snap off, in much the same manner as ordinary steels. For chromium-nickel steels, however, punches must penetrate almost entirely through the stock before fracture occurs.

Working faces of punches and dies must always be kept sharp to prevent cambers and excessive burring. With trimming operations, dull cutting tools may turn over the edge instead of cutting through the metal. Close clearances must be maintained between the punch and die to prevent metal from being drawn into the die. Generally, a clearance of one-tenth the thickness of the metal is recommended.

Power requirements, which depend upon shear strength of the workpiece material, are approximately 40 percent more for austenitic grades than for mild steel. Blanking pressure, however, can be considerably reduced by using stepped punches or perforators, *Fig.* 2. The dimensional difference between successively stepped punch working faces should be approximately one-half the thickness of the stock. This practice lowers the total instantaneous blanking pressure, or power required, to that needed for one punch. The diameter of perforators

—Photo courtesy The Blaw-Knox Co.

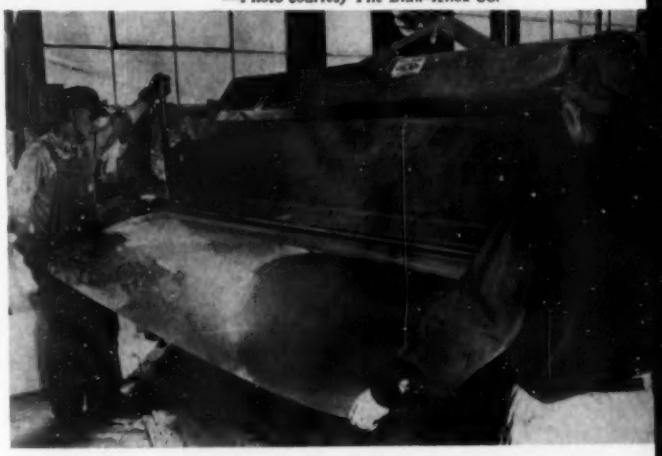


Fig. 6. Bending Type 302 stainless steel on a 10-foot press brake. Sheets are formed into chamber covers for large spray dryers used in milk dehydration.

should usually be equal to at least twice the diameter of the stock to prevent breakage.

Blanking pressures can also be greatly reduced when blanking and piercing stainless steel by applying shear to the cutting edges of the punch or die. This is done by grinding angular or radial relief on the working face of either member, *Fig.* 3. This method permits tools to cut into the work gradually instead of taking the full load at one time. When a flat blank must be produced, shear is ground on the die opening and the cutting face of the punch left flat. Any distortion produced will occur in the stock or scrap material. Shear on a punch or perforator destroys the blank or slug produced. When punched sections are to be discarded, shear should be applied on the punch.

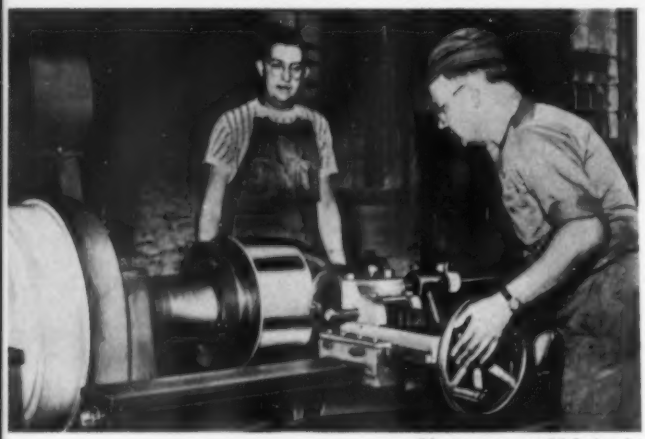
Equipment for brake shearing stainless steel generally requires from 30 to 50 percent more capacity than is needed for plain carbon steel, *Fig.* 4. Blades must be kept sharp and maintained with very close adjustment, especially with thin stock, to produce a clean cut. As with trimming dies, cutting narrow margins with a dull shear blade will cause the metal to be turned over instead of severed from the stock. Blades should be made from high-speed steel and provided with as much lip clearance as can

be maintained without chipping. The same general recommendations for straight line shearing also apply to circle shearing operations, *Fig.* 5.

Brake Forming: Greater power and heavier tools are also needed in brake forming stainless steel than are used for mild steel, *Fig.* 6. Generally, forming pressures which are suitable for carbon steel four gages heavier should be used for any gage of stainless steel.

To control excessive springback, the work can be bent to an angle greater than that desired. The punch angle can also be made one to two degrees less than the die angle, and a slight radius ground in the Vee of the die. The punch will then force a small amount of metal into the clearance space in the die block, and provide a permanent set.

For bending austenitic steels, which are comparatively ductile, a minimum punch radius of one-half of the metal thickness is generally recommended. A radius of approximately six times the metal thickness, however, may be needed for hard tempers of the austenitic and ferritic grades.



—Photo courtesy ACF Industries

Fig. 7. Spinning a 30-quart industrial mixing bowl from Type 302 stainless steel. Part was previously drawn from 16-gage sheet stock.



—Photo courtesy Portland Copper & Tank Works, Inc.

Fig. 8. Spinning a tank header from Type 304L stainless steel. The spinning tool is made of hardened steel and the workpiece is mounted on a steel form.

Tube Bending: Tube bending operations are most influenced by the outside diameter of the tube, wall thickness, and bend radius required. Where bending conditions are such that no mandrel is required, it is still generally advisable to support the inside surfaces of the tube to prevent collapsing. For limited production this can be done by using a filler such as sand, rosin, a spring, or a low melting alloy (Wood's metal). Bends on large thin tubes to a relatively small bend radius are the most difficult. Large-diameter tubing tends to thin and flatten in sharp bends because of the greater differential in stretch between the inside and outside metal while thin-wall tubing tends to wrinkle.

Difficulties arising from a thin wall, a large diameter, or a sharp bend radius are compensated for in tooling, primarily by supporting the tube wall. For a simple bend a plug mandrel that supports the tube up to the point of bending is sufficient. More difficult bends require that the tube be supported into the bend itself, necessitating the use of a one-ball or two-ball mandrel.

Spinning: Heavy equipment and high power are also required for spinning stainless steels, *Fig.* 7. Spindle speeds should be approximately 50 percent of those used for ordinary steels. These modifications are necessary because of the greater strength and resistance to flow of stainless steel. For deep spinning operations, one or more anneals may be necessary. Excessive spinning before annealing will produce stresses which may crack or split the work. Type 305 work-hardens less rapidly than Types 302 or 304, and imposes less resistance to flow. This material was especially developed for spinning, and in some cases may be spun without annealing. It is widely used for coffee urn tops, reflectors, and similar products. Type 430 and, to a lesser extent, Type 410, also provide exceptionally good spinning qualities.

Bar or roller type tools used for spinning operations should be of hardened alloy steel or hardened nickel-chromium cast iron for best results, *Fig.* 8. Tools must also be highly polished and provided with a generous bearing surface. Bar soap is generally recognized as the best lubricant and is frequently mixed with cup grease or heavy polishing tallow to promote spreading. Since spinning destroys any surface finish, a No. 1 finish, which also helps to retain the lubricant, should be used.

Other aspects of stainless steel fabrication will be discussed in future articles. These include joining, heat treatment and finishing.

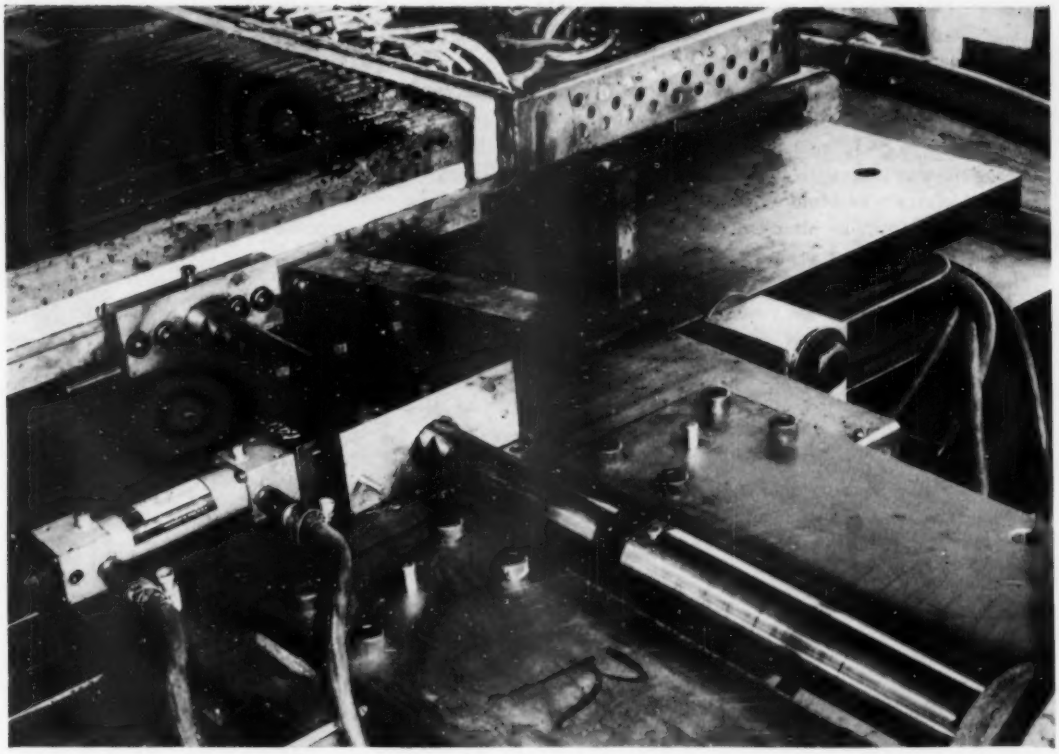


Fig. 1. Indexing mechanism of the lower die section for corrugating titanium sheet. The protective insulation panel has been removed to expose the indexing rod and air-actuated locking pawl.

Hot-Forming Titanium

with adjustable-section dies

By Ed Selmer
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Faced with the problem of corrugating titanium sheeting, engineers developed a die with adjustable sections to form and coin the part. Developments in the design and use of the dies are outlined by the author.

DEVELOPMENT OF TECHNIQUES for hot-forming corrugations presents one of the more interesting manufacturing problems in the use of titanium alloys. The material must be formed at about 1200 F, which complicates die design. Forming at elevated temperatures presents three main problems:

1. A source of controllable confined heat is necessary
2. A cooling system must be used to protect equipment
3. A die material which will withstand both heat and wear is needed.

A variety of hot-forming dies, *Fig.* 1, have been designed to produce aircraft parts. A particularly difficult tool to develop was the die for forming corrugations in 0.039-inch sheet, *Fig.* 3. Design requirements called for the use of corrugated sheet for interior structure and for sandwich type skin

panels. The close forming tolerances plus the tolerances of the sheet material created a difficult development problem.

Since the sheets are too wide to draw in one operation, a procedure was needed to allow each corrugation to be formed separately. This forming operation was followed by a coining operation. Coining serves a two-fold function: it prevents the corrugations from becoming distorted during subsequent forming, and provides a method of stress relief.

A multipurpose die that would be capable of producing a multiple number of corrugations and inline and offset parallel flanges in sheets of various lengths was desired. To fulfill these conditions, an indexing system was designed to move the lower die, one corrugation at a time, across the forming punch and into the coining area, as shown in *Fig.* 2. Notched draw rods actuated by air cylinders and located by air-actuated pawls provide an accurate indexing system, *Fig.* 1. The lower die is guided by five rails with pads between them to provide the required bearing surface.

To protect the indexing system, the guide rails and the bearing pads from heat radiated by the upper die, shielding is necessary. It should also

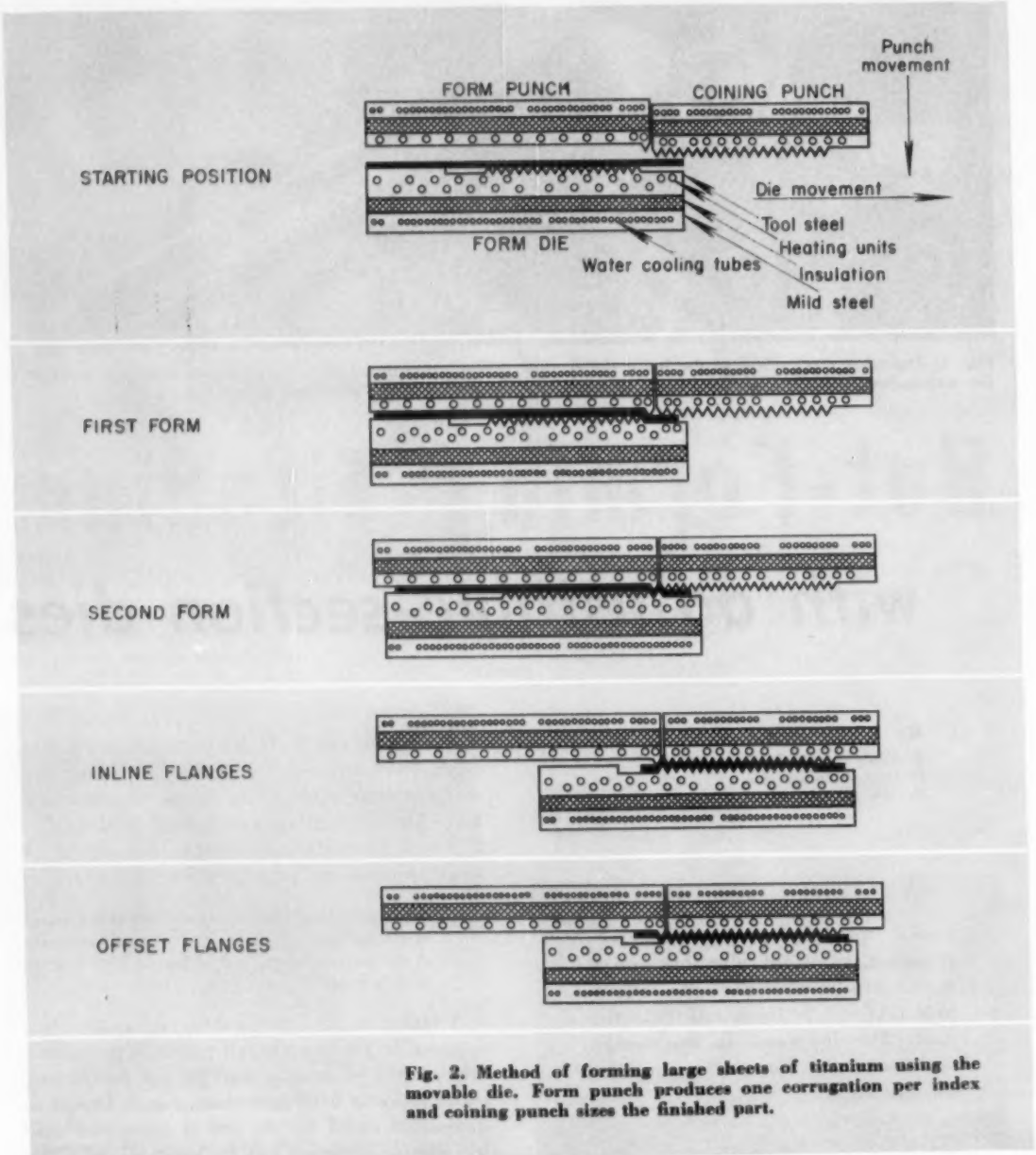


Fig. 2. Method of forming large sheets of titanium using the movable die. Form punch produces one corrugation per index and coining punch sizes the finished part.

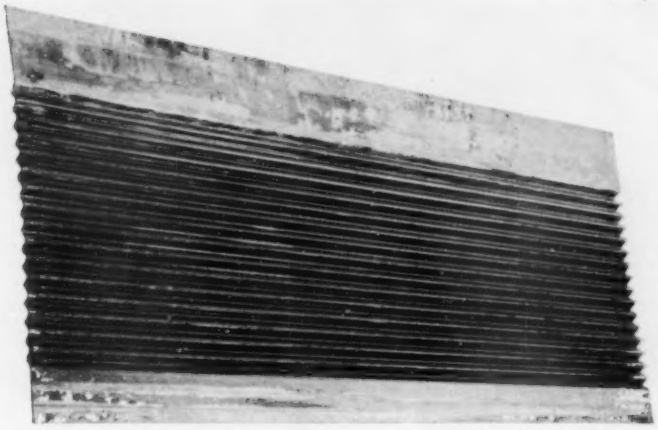


Fig. 3. Corrugated sheet of titanium prior to trimming, scale removal and cleaning. Large size of the sheet prevented forming all corrugations at one time.

protect the operator as well as minimize heat loss. Therefore, panels made of insulation encased in stainless steel are attached to both the front and rear of the die as shown in *Fig.* 4.

A die material was needed which was nongalling and which had low oxidation and deformation characteristics at elevated temperatures. Since the die was required for limited production use only, class H-13 tool steel was selected. The die was heat-treated to R_C 38 by drawing at 1250 F, and was finished by crush-roll grinding.

Expansion slots or grooves are provided to allow for expansion and contraction of heating elements and water cooling tubes during the heating cycle. To prevent seizing of screws in the heated die, threaded inserts and stainless steel screws are used. This construction permits easy dismantling of the die to replace burned out heating elements.

Die temperature is controlled by three chromel-alumel thermocouples located adjacent to the forming surface with leads running in milled grooves on the cold side of the die. To prevent open thermocouple readings, the stainless steel sheathing has been lanced, the wires twisted together and the casing welded shut. With the contact end held in place by a setscrew, the thermocouple functions perfectly. Resistance-wire elements which provide the heat, are rated at 5800 w each. A total of 280 kw is needed for die heating.

A special Boeing-developed ceramic lubricant is used to prevent galling. This ceramic material, a soda-boro-aluminate type glass, produces good results but some ceramic build-up can be noted on the dies. When build-up becomes objectionable, it can be removed by forming an uncoated part.

Development of the elevated temperature dies and the technique for using them solved the problem of forming corrugated skins of titanium alloy. Considerable care is necessary in meeting the close tolerances required by the design engineer. Operating at 1200 F with forming pressures up to 1150 tons, there is a tendency for the peaks of the corrugations to flatten out. Ceramic build-up on the die must be controlled. With these exceptions, the forming of titanium is no more difficult than the forming of aluminum.

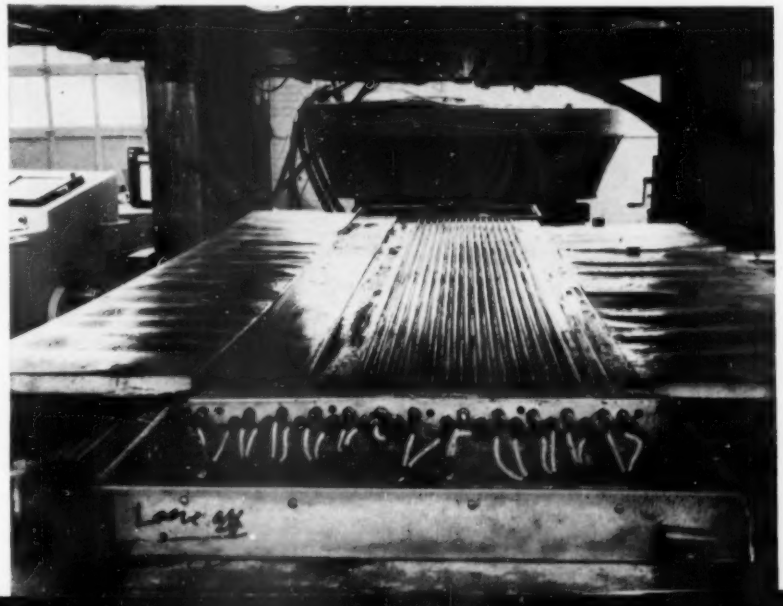
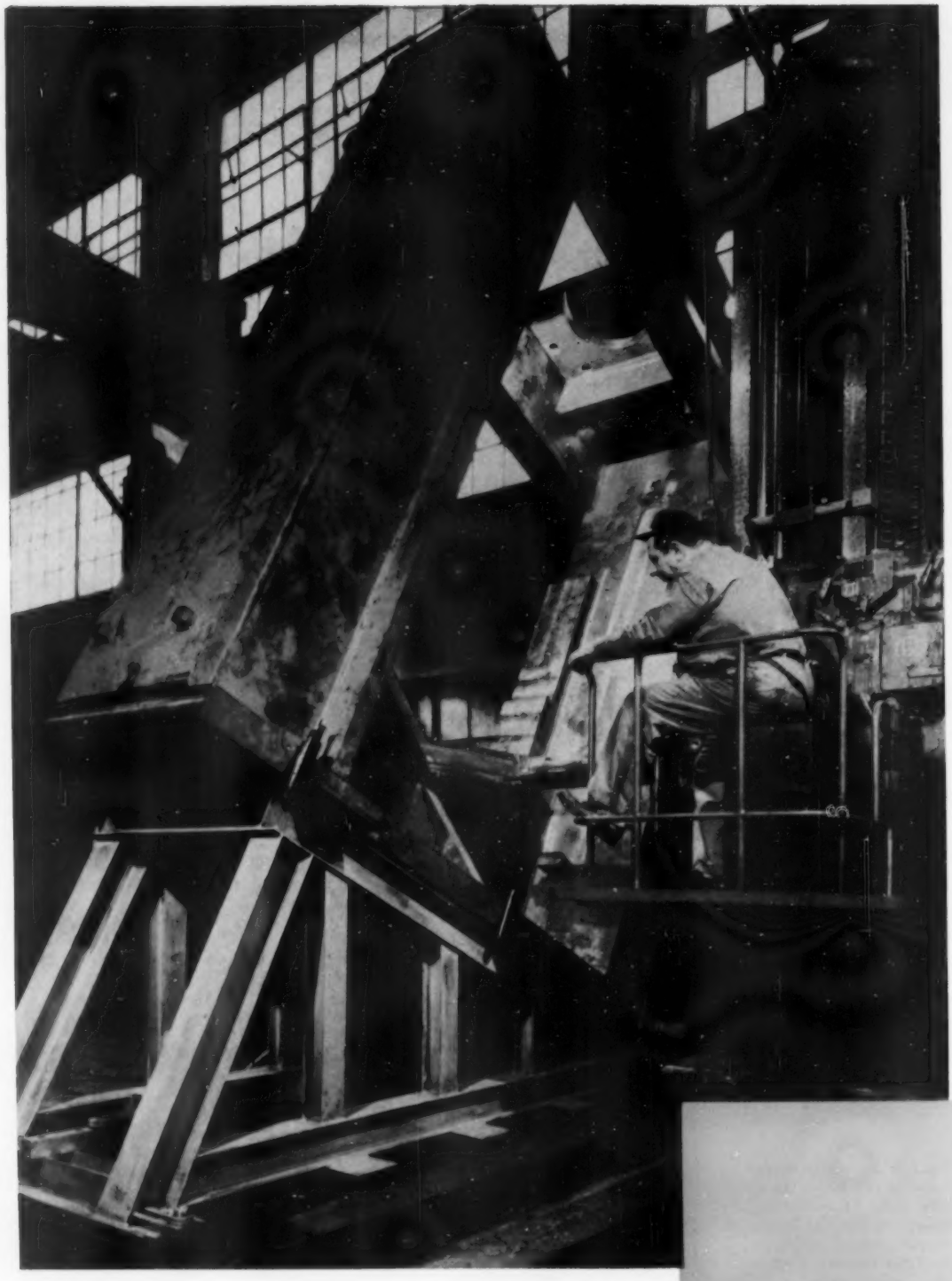


Fig. 4. Longitudinal view of the lower forming die. The forming punch is located at the upper center section and the coining area at the upper right. Connections to the heating elements are located in the junction box in the foreground.



WELDED POSITIONER is used to tilt the 27-ton frame of a scrap press at Baker-Perkins, Inc. This enables V-shaped angles of the unit to be placed under head of a Giddings & Lewis horizontal boring mill. The angles can then be machined on a horizontal plane. Machining time is 20 to 24 hours.

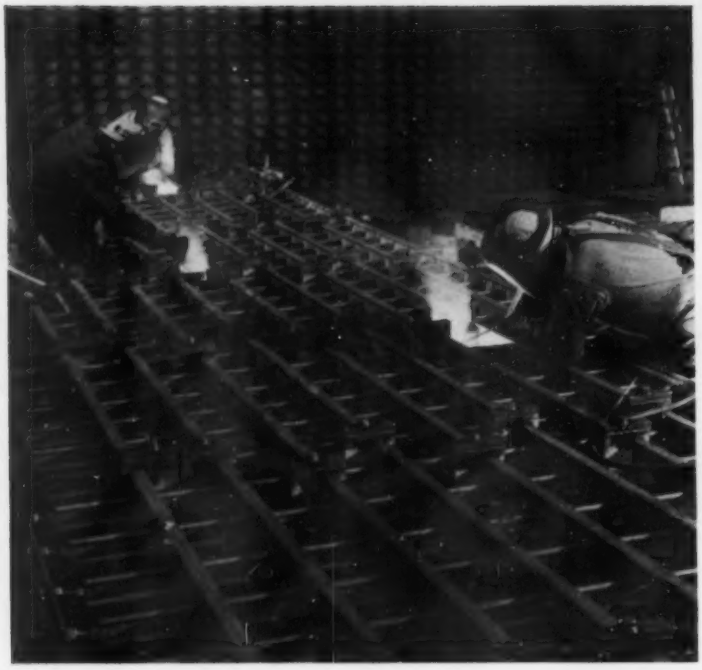


NUCLEAR FUEL PELLETS are formed from powder at the Westinghouse Plant at Blairsville, Pa. Uranium oxide powder and organic binders are blended in mixer, dried and fed into an automatic press. The press forms the material into cylinders. After sintering, the pellets are transferred to grinders to produce final dimensions.



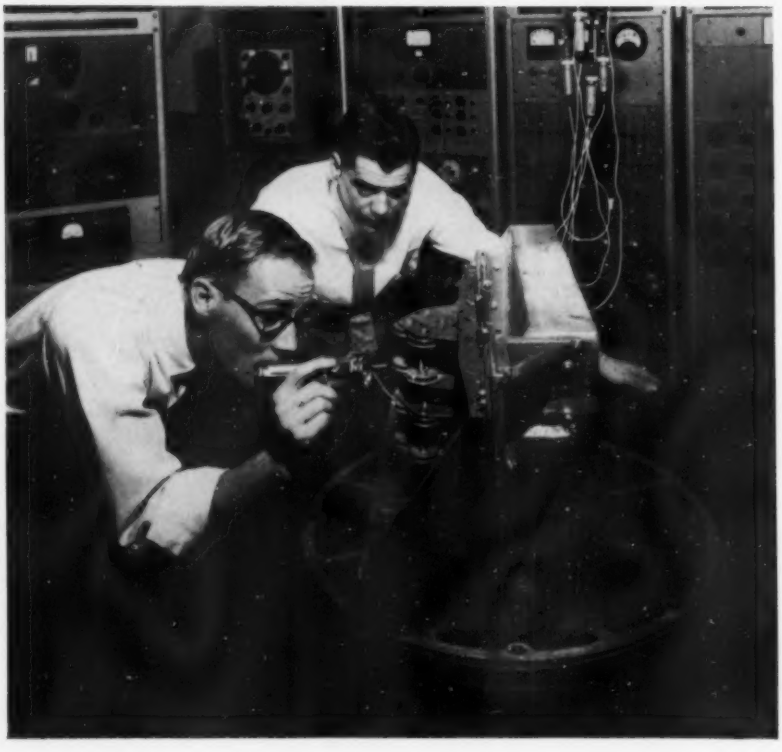
EACH CERAMIC FUEL PELLET must pass a number of quality control tests. Pellets are measured for length and diameter on this testing table shown here. Tolerances are less than one-thousandth of an inch.

TOOLS at work



ARC WELDING of the 360 intersections in this 26 x 7½-foot steel floor grid for the Greater New Orleans cantilever bridge required the development of special fixtures with as many as 70 hold-down clamps and compensating devices to minimize the heat effect of welding. Blaw-Knox Co. developed equipment, fixtures and welding procedures for assembling 700 of the panels, each weighing over 4000 pounds. Two are placed end-to-end and welded to the bridge floor framing to form one section of the 52-foot five-lane roadway. Welds on the underside covering strips are intermittent fillets. Welding is done with Lincoln Jetweld 1 (AWS E-6024) rod.

TOOLS at work



CONTROL system bracket for a bomber is tested under random vibrations which match the range of jet engine sound. This electromagnetic vibrator for testing various aircraft parts and components is capable of exerting forces up to 7500 pounds in simulation of actual flight conditions. Equipment was designed and built by Boeing Airplane Co.

PROCESS CONTROL keeps weight down

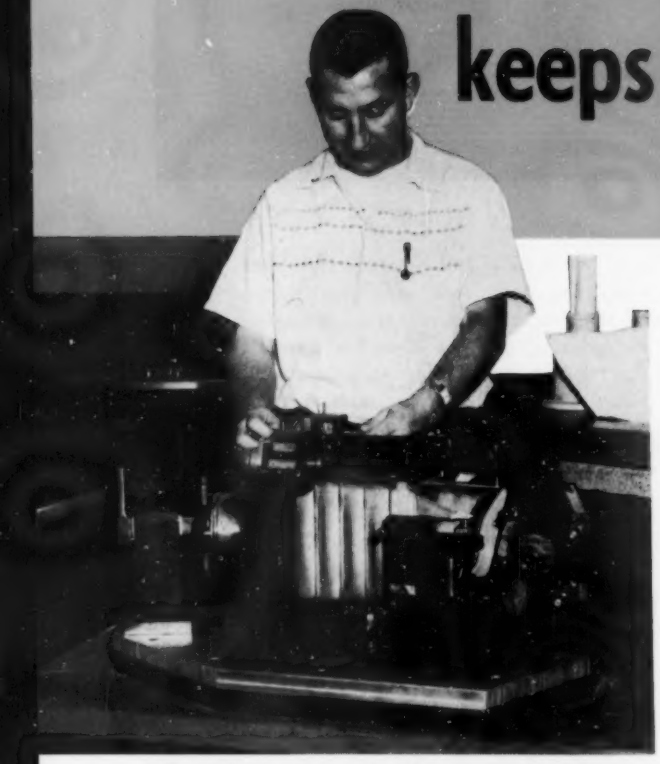


Fig. 1. Dimensional check fixture for final heat exchanger assembly represents one of many manufacturing controls necessary to meet specifications of light weight and minimum size.

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Reliability is a prime consideration in aircraft and missile components; however, the manufacturer must recognize and provide for another important factor—weight. This article, a case study, illustrates how carefully manufacturing processes must be controlled to obtain the optimum of each.

IN ADDITION TO maintaining high reliability, the manufacturer of components for the aircraft industry must carefully control the critical elements of product weight and size. He must strike a balance to avoid weight penalties from over design, and lack of reliability from inadequate safety margins. Consideration of these factors, of course, begins in product design, but also must be carried throughout the manufacturing process.

Manufacture of heat exchangers, *Fig.* 1, exemplifies how close process control is necessary to maintain quality while holding weight to a minimum. A typical exchanger used in an aircraft air conditioning system weighs only 18 pounds. A standard commercial-industrial unit with the same heat-exchange capacity weighs 130 pounds.

Construction: The exchangers are of a platular design which affords certain basic advantages. The raw material for the heat transfer surface is in its cheapest form—flat sheets; providing a cost savings of 25 to 35 percent over using thin-wall, drawn stainless steel tubing with equivalent heat transfer area. Platular construction allows the core to be made in sections or modules, *Fig.* 2, so that scrap losses are lower in case of part rejection during manufacture. In addition, a change in requirements necessitating changes in tube length, pitch, diameter and tube number results in a minimum tooling expenditure.

The raw material for the plates is type 347 stainless steel in sizes ranging from 0.003 to 0.005 inch thick in coiled strip. Thickness tolerances are ± 0.0005 inch. The stock is corrugated and brazed together to form the passages for fluid flow. Corrugating is performed on a hydraulic press, *Fig.* 3, in a two-stage die, *Fig.* 4, with an indexing hold-down stage and a forming stage. This allows the

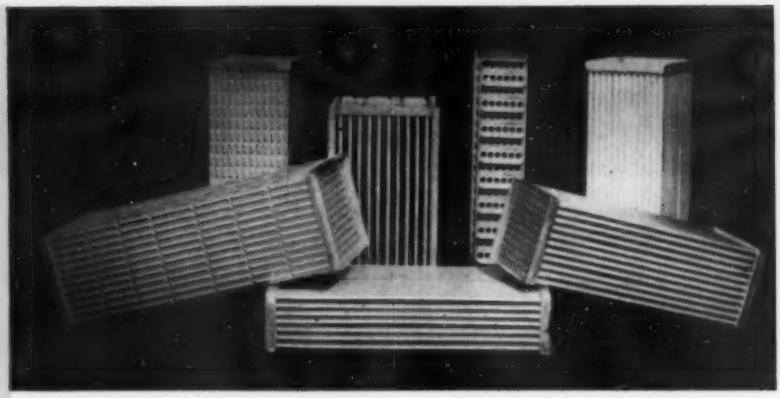


Fig. 2. (right) Platular design affords versatility in construction. Cores can be made in modules providing numerous variations of final size and shape.

Fig. 3. (below) Stock for plates is corrugated on a press to form exchanger tubes. Coil stock is formed with a minimum of metal stretching by making only one convolution per press cycle.



forming to be a metal-gathering process rather than a stretching process. The operation of the die and stock feed mechanism is set up as a part of the automatic sequencing panel of the press and is controlled by a variable electric-hydraulic system. The program sequence allows two different metal transport distances and a variable number of corrugation cycles and cutoff. The die is compensated for metal spring back so that the resulting formed shape is $\frac{3}{16}$-inch diameter semicircles attached by a 0.040-inch flat land with a projecting land of 0.100 inch on each edge of the plate.

The die is double acting with one spring-loaded segment and one fixed segment. On the first press stroke two corrugations are formed with the metal flowing into the cavity both from the stock free end and the reel end. On all subsequent cycles the index moves the material to approximately the correct position. The spring-loaded segment accurately indexes from the last-formed corrugation and retains this corrugation while the fixed segment forms the new corrugation bringing material from the reel end. The stock feed is a gravity-actuated cam friction feed which firmly grips the material during the indexing cycle but allows free movement during the forming cycle. This operation with properly balanced forces allows the material to be formed with less than 5 percent thinning even with bend radii from 0.005 to 0.007 inch.

After the plates are sheared, they are restruck in a metal-metal die to bring them to final form ± 0.001 inch. If dimpling is required to raise internal heat transfer, the plates are transferred to a dimpling die which can either be matched metal or a metal male and trapped rubber. The next operation is the edge wrap in which the 0.100-inch edge is formed into a circular shape slightly smaller in diameter than the nominal tube diameter. This is a two stage die which first grips the part and then wipes the edge around. After the edge wrap, the parts are thoroughly vapor degreased and stored in plastic bags until ready for spot-welding. If the heat exchanger design requires a more compact surface than allowed by the plain tube, an inner fin is used. This fin may be a flat sheet or it can be formed to give more surface or tube blockage.

Assembly: The clean plate halves, and fins, if required, are assembled by snapping together the edge wraps. The assembled plate is placed in a specially designed holding and indexing fixture and the lands are spot-welded on approximately 1-inch centers with shaped electrodes, *Fig.* 5. The function of the spot welds is to jig the plate assemblies for final assembly and brazing. The spot-welded plate assemblies are placed in an assembly fixture which accurately locates them so that the headers can be installed. The headers are made of 0.025 to 0.62 inch thick 347 stainless punched with a hole pattern which is with ± 0.002 inch of true position. Header flanges are welded at the corners after forming. The headers are started on the tube ends and the fixture is placed in a horizontal press to firmly seat

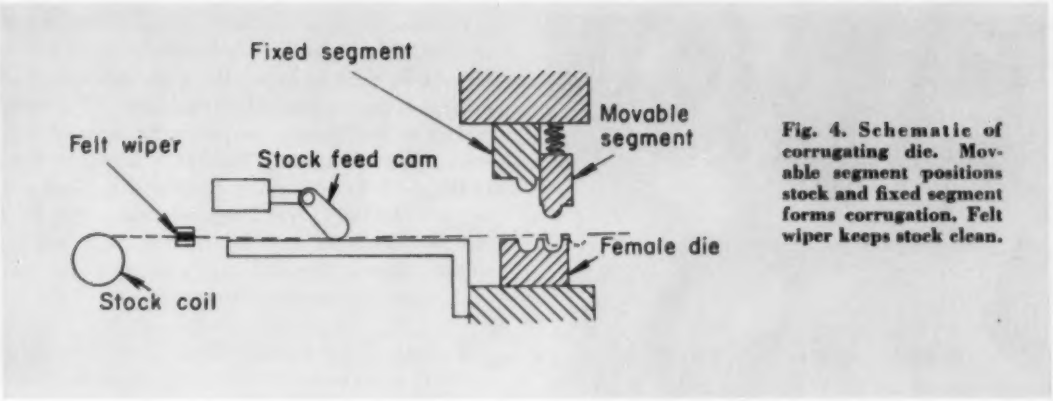


Fig. 4. Schematic of corrugating die. Movable segment positions stock and fixed segment forms corrugation. Felt wiper keeps stock clean.

them on the fixture. All the tube ends are then flared over simultaneously, using formed mandrels set in a drilled block. A horizontal press is used for this flaring.

Since considerable welding is required on each unit, weld rod addition could radically affect weight; as much as 1 lb in a 10-lb unit. Weld bead height and width are controlled to maximum values and, where possible, joints are designed to require no rod addition.

Brazing: After assembly, the modules are again cleaned by vapor degreasing. Immediately after cleaning braze alloy is applied. Nickel-boron-silicon alloy with a 160-mesh or smaller grain size is used. The brazing powder is mixed with an acryloid binder and sufficient thinner to allow spraying with a commercial spray gun with a pressure cup. The alloy-binder mixture is sprayed on each header in carefully controlled amounts, depending on the size and configuration of the module, *Fig.* 6. Application of brazing alloy is maintained to a tolerance of ± 0.005 pound per module. After spraying, the modules are placed in plastic containers to maintain cleanliness and brazed within 24 hours.

Brazing is accomplished in an A-frame, belt type furnace with a dry hydrogen atmosphere. The brazing temperature is between 1900 and 2000 F with the atmosphere dew point controlled to a —65 F or lower.

Handling: Cleanliness is the key to success in the brazing operation. Each brazed module presents approximately 500 to 750 junctions to be successfully brazed. Approximately one-half of these junctions are inaccessible for cleaning after assembly for brazing. The hydrogen atmosphere of the brazing furnace and the flux in the brazing alloy can adequately reduce a moderate amount of oxides on the material surface, but any foreign material such as oil, grease—even a fingerprint—can impede the necessary capillary flow of the brazing alloy and a pressure resistant structure will not result.

In order to maintain required cleanliness, particular attention is paid to handling and cleaning techniques. During, and at the completion of, all forming operations, the parts are cleaned in a vapor degreaser. If possible, the plate halves are assembled and spot-welded immediately after the final cleaning. If they must be stored, they are placed in clean polyethylene bags and sealed. After spot-welding, the plates are assembled into modules and again cleaned by vapor degreasing and stored in polyethylene bags until alloy is to be sprayed. Alloy is sprayed on the modules within 24 hours of the time they are to be brazed and the modules are

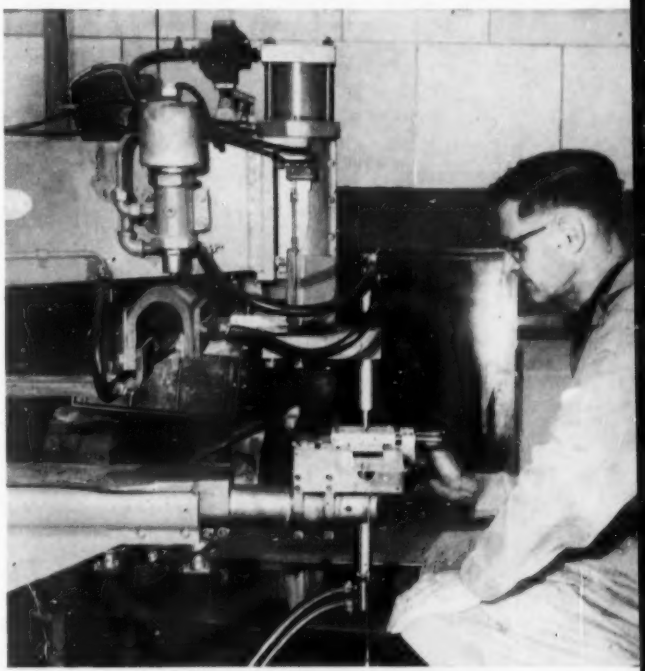


Fig. 5. Plates are spot-welded together with shaped electrodes. This operation jigs the plates for brazing.



Fig. 6. Modules are carefully weighed after brazing. Application of brazing alloy is held within tolerance of ± 0.005 pounds per module.

again stored in the polyethylene bags. If modules are not brazed within 24 hours, oxidation of the granular alloy prevents proper flow. Alloy must then be removed with a suitable thinner and fresh alloy applied. The close control of part and assembly cleanliness pays off by producing brazed assemblies with less than 0.01 percent unsatisfactorily brazed junctions.

The plates as formed are relatively immune to damage from normal handling so long as care is maintained to prevent their being rubbed across some abrasive surface. This is done by storing them on end in wire baskets. The principal source of damage is the presence of foreign particles or metal pickup in the forming dies or on the original strip stock. The corrugating die has a wiper attached to the stock feed to assure starting with clean materials. All dies are inspected and cleaned at frequent intervals and the formed parts are inspected during the forming operations for any evidence of deformation or scratching.

Testing: After brazing, all modules are pressure tested to a pressure of 1.25 to 1.5 times the maximum operating pressure to test for braze soundness and leakage. A piece from each braze lot is sectioned and examined for braze alloy flow and penetration. After testing the modules are assembled as required for the specific application and the necessary collectors, connections and brackets added to meet required customer envelope configuration.

Finished plates can withstand internal pressures of 2300 psi. The pressure resistance of the module assemblies varies according to the header sheet stiffness and can approach the plate assembly pressure resistance. The tooling necessary for assembly configuration change is a dimple die, a header punch stock guide, header form die, and module assembly fixture. All are moderate in cost.

Strict quality control is necessary to maintain the standards required for satisfactory parts. Frequent inspection for dimensional correctness and cleanliness of the parts is mandatory. This strict control is the only way a manufacturer can provide guaranteed minimum weight for a given performance.

Tapping with a Drill Press Setup Nets Advantages

MANUFACTURERS can accumulate a number of advantages for their operations by utilizing a drill press with a reversing motor for tapping. Ben Eldridge, metalworking products manager of Delta Power Tool Div., Rockwell Mfg. Co., has outlined several points for consideration. Primarily, the setup provides a specialized machine at considerable economy, with little or no loss in productivity. Drill presses used for direct tapping have attained production rates of 500 pieces per hour.

To accomplish the conversion requires a reversing motor, a control station consisting of a drill-off-tap selector switch and an emergency stop button, a tripper arm attached either to the drill press depth stop or the quill itself to actuate limit switches at top and bottom of spindle travel, and a reversing magnetic starter. Any three-phase motor may be wired for reversing. Pneumatic feed devices, often used in reversing-motor drill press setups, limit operator's work to loading and actuating each cycle.

Direct tapping facilitates use of multiple head accessories. The greater power requirements are easily met with a reversing motor because there is no friction clutch and no lost power. Use of the adapted setup requires no special skill. Further, the tap provides its own lead, and practically no thrust is transferred from the machine to the tap. Thus, a sensitive tapping action is provided with no "shaving" of the threads. Because only a rotating force is applied to the tap, a maximum tap life may be expected.

safety for eccentric presses

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Protective devices for eccentric presses have established an outstanding accident-free record at Philips Industries. Frequent adjustments are not necessary, making maintenance easy, and unnecessary motions are not required, providing high production.

THE TEST of any safety device is its record of accident-free operation. A safety mechanism applied to eccentric presses, *Fig.* 1, at Philips Industries has an outstanding record of performance over an extensive period of time. Construction eliminates some of the drawbacks of other systems which are in common use.

Usual Methods: Press operator protection is often accomplished with two-hand devices where the operator must press two levers or pushbuttons simultaneously. An operator can, however, defeat the functioning of this type of system by holding one switch or button with wire or string. In some cases an operator may still get a hand under the press before the ram reaches the lowest position.

The friction clutch, which in many respects is a versatile machine component, provides good protec-



Fig. 1. Battery of small presses with Philips protection devices. Press will not operate until guard is closed and foot pedal is pressed.

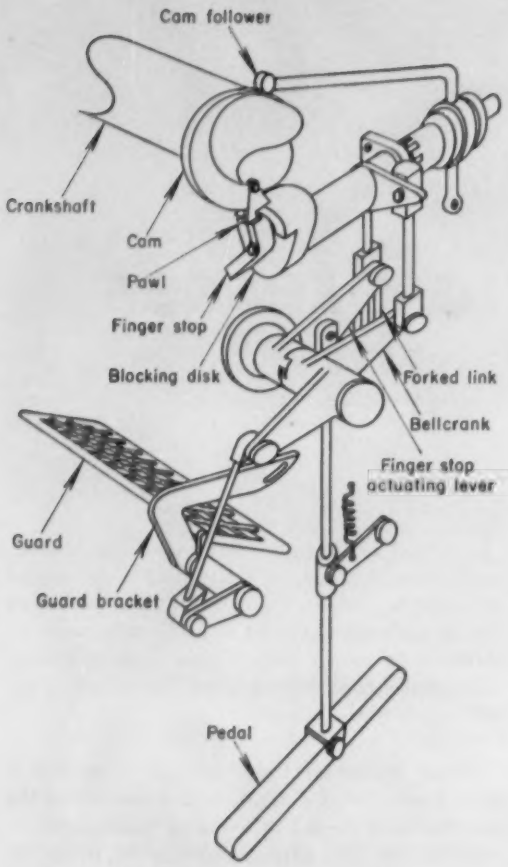


Fig. 2. (left) Safety device for eccentric presses. Guard is shown in up position. Blocking disk and finger stop keep the crankshaft from turning.

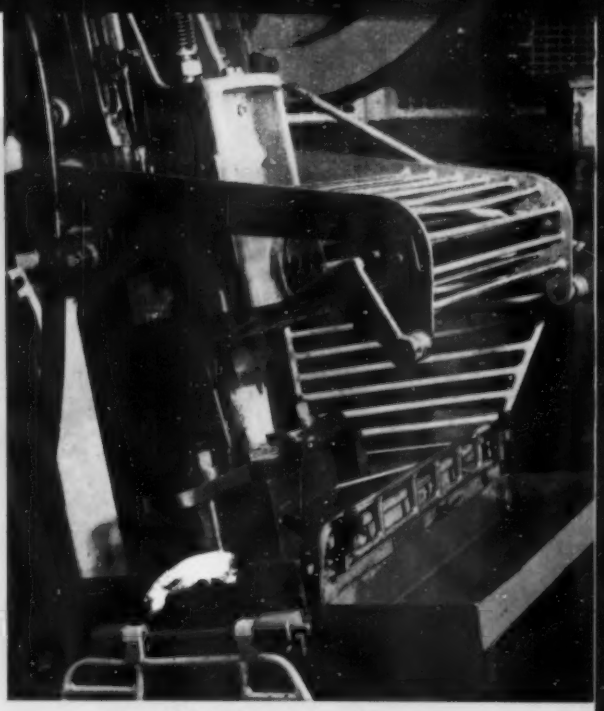


Fig. 3. Guard in up position on a small press. Finger will not release until guard is fully down. Side guard has been removed for visibility.

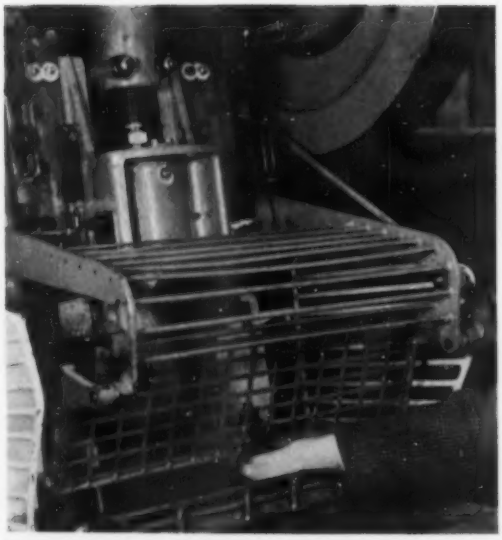


Fig. 4. Guard nearly closed. Blocking disk and finger stop still prevent the crankshaft from turning.

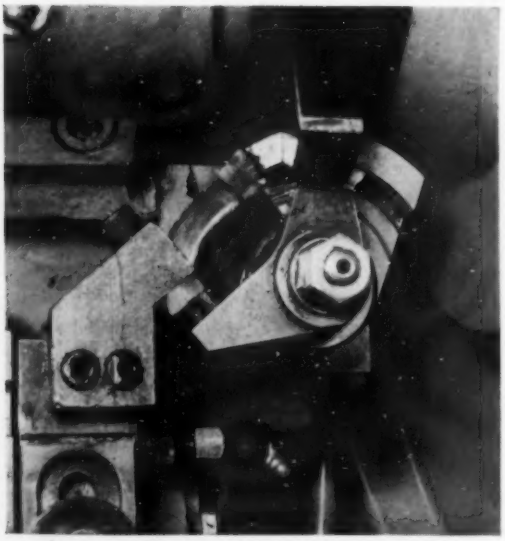
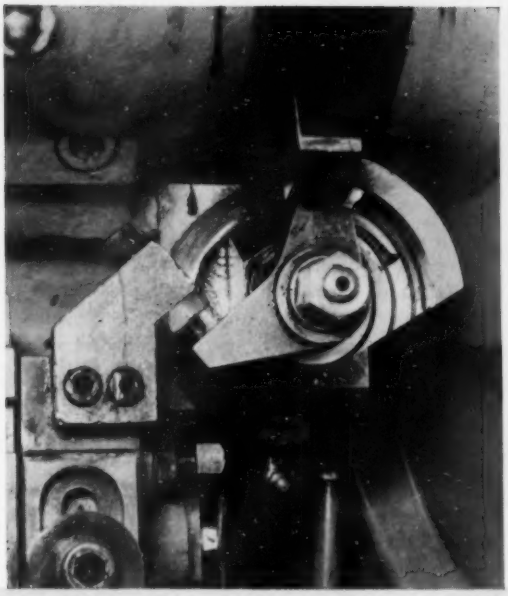
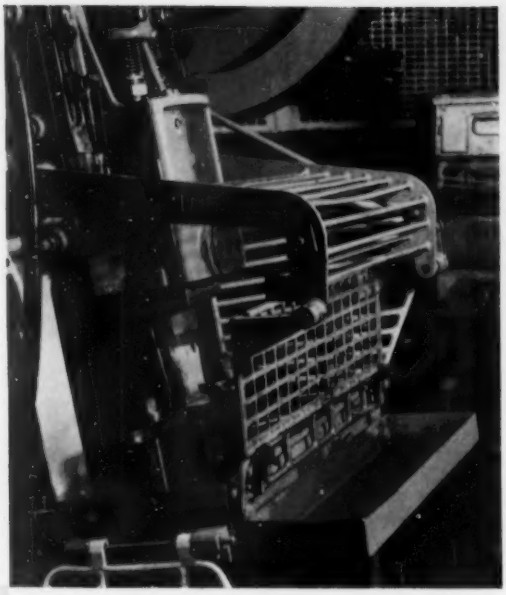


Fig. 5. Finger stop and blocking disk in blocking position. Guard is up and pedal is not depressed.





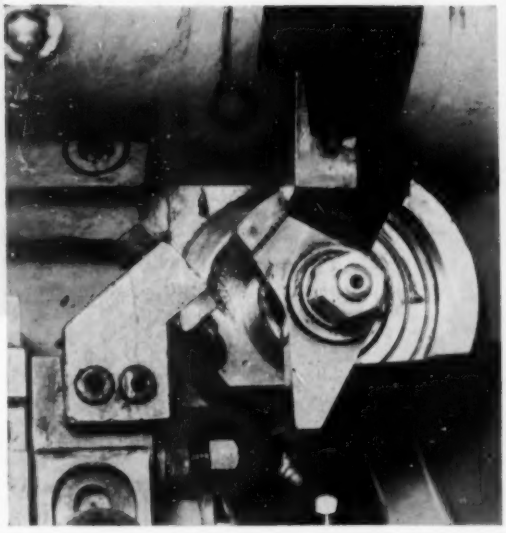


Fig. 6. (above) Blocking disk almost disengaged. Finger stop just beginning to move.

Fig. 7. (upper right) Guard closed. Press just in gear. Ram beginning to descend.

Fig. 8. (left) Guard closed. Pedal fully depressed. Pawl is released engaging rolling key. Ram beginning to descend.

tion. With it, the ram can be stopped at any point in its descent when one of the switches is released. Relatively high cost has been a bar to its use for presses under 25 tons.

The Philips system is a purely mechanical device and does not rely on electrical or pneumatic components which could cause failure. The reliability is not dependent on precise adjustment and the system is immune to unexpected fracture or malfunctioning of the press coupling elements.

Operation: The safety mechanism is shown in *Fig.* 2. When the foot pedal is pushed down, the bell crank and finger-stop actuating lever are rotated. Between these two, there is a small amount of angular free play. In normal operation, however, they are directly engaged and are subject to the same angular displacement. The bell crank closes the guard, *Figs.* 3 and 4, and rotates the blocking disk, *Fig.* 5, from behind the pawl on the crankshaft. The finger-stop actuating lever, connected to the finger stop by means of a forked link and a claw coupling, moves the finger stop out of the blocking position, *Fig.* 6. The free stroke in the forked link is made large enough to allow the blocking disk and the finger stop to reach the extreme open position at the same time; hence the guard is almost closed, *Fig.* 7, when the finger stop starts to move. When the finger stop and blocking disk have turned completely, *Fig.* 8, the pawl turns a rolling key, the crankshaft and flywheel are coupled, and the ram descends.

The blocking disk is so designed that it cannot enter the opening between the cam and the pawl when the pawl is released. The blocking disk can move back into blocking position only after the cam has moved past it. This occurs just before the ram



Fig. 9. Guard turned up for maintenance of dies. No major adjustments are necessary.

reaches the bottom of the stroke. The guard cannot open until then; hence, the operator cannot put his hand into the press until the downstroke is complete.

The finger stop is turned back by a spring when the foot pedal is released. If pressure on the pedal is maintained, the cam releases the claw coupling disengaging the linkage between the finger stop and the foot pedal. The press, therefore, can complete only one stroke; the guard remains shut and cannot be opened until the stroke is completed.

The cam and pawl are in the same plane so that when the blocking disk or finger stop move into blocking position the pawl shifts the rolling key and the link between the crankshaft and flywheel is broken. The mechanism is applicable also to claw or friction clutch machines and works equally well on inclined presses.

Other Operations: The safety system may be arranged so the guard is not used when required for operations or when access to the dies is necessary. In this case, the guard is turned up, *Figs.* 9 and 10, and the bell crank keeps the blocking disk out of position. The coupling between the bell crank and finger-stop actuating lever allows a free rotation of about 20 degrees; hence, the actuating lever is rotated to a lesser degree but completely taking up free stroke of the forked link. When the pedal is pushed down, the finger stop is released allowing the press to cycle.

For continuous strokes of the press the cam follower is removed from the cam. The press will then repeat as long as the foot pedal is kept depressed.

Results: This mechanism allows the operator to keep both hands free while running a press. No extraneous motions are required for operating buttons or switches. On small presses, effort required for operation is small and not fatiguing. For larger presses an air cylinder may be attached to operate the pedal for convenience. Studies revealed this method may afford 10 to 30 percent higher production than two-hand switch systems. Presses to which this device has been applied have been operated for 25 years for two shifts without accident.

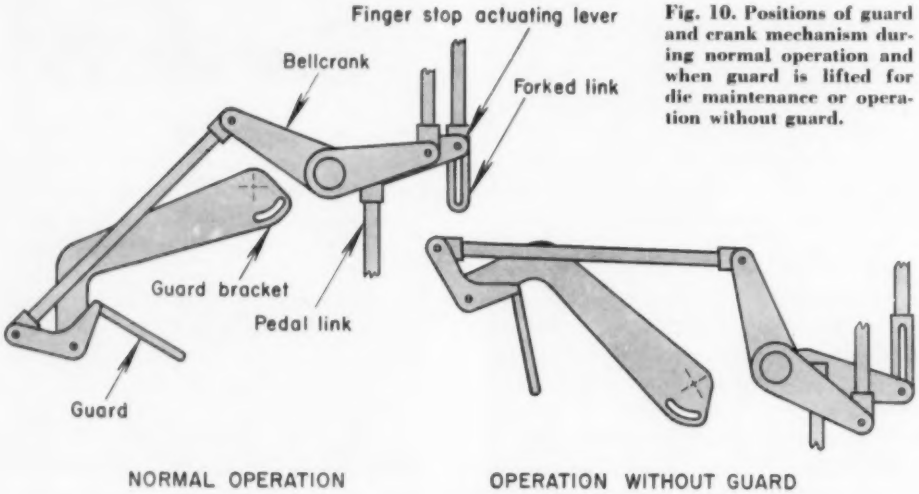


Fig. 10. Positions of guard and crank mechanism during normal operation and when guard is lifted for die maintenance or operation without guard.

dimensions for SEMITUBULAR RIVETS

RIVETING IS USED to fasten leather, rubber, paper, plastics, wood and most metals. Design and tooling for riveting are aided by knowledge of standard dimensions and tolerances.

New standards for semitubular rivets cover body diameter and head dimensions for three head styles: oval head, truss head, and flat countersunk head. An oval head is semielliptical with a flat bearing surface. A truss head has a low rounded top surface with a flat bearing surface of larger diameter than a round head. A flat countersunk head has a flat top and a conical bearing surface of 150 degrees.

Standard lengths for semitubular rivets are covered in TABLES 1 and 2. Maximum radii which have been established for the fillets under the heads of oval and truss head rivets are listed in TABLE 3. Head and body proportions for the three types of rivets are shown in TABLES 4, 5 and 6. Rivet length is measured from underside of rivet head.

For all types described in the tables, the hole depth shall not be greater than shank length. Because the heads of these rivets are not machined or trimmed, the circumference may be somewhat irregular and edges may be rounded or flat.

From "Dimensional Standards for Semitubular Rivets" prepared by Tubular and Split Rivet Council.

Table 1—Length Increments

Nominal Rivet Size (inch)	Length Increment (inch)	Minimum Length (inch)
0.061	1/64	1/16
0.089	1/64	5/64
0.099	1/64	5/64
0.123	1/64	3/32
0.146	1/32	1/8
0.188	1/32	5/32
0.217	1/16	3/16
0.252	1/16	7/32
0.310	1/16	1/4

Table 2—Length Tolerances for Semitubular Rivets

	Length Tolerance (inch)		
Nominal Size (inch)	Up to Four Times Body Diameter	Four to Eight Times Body Diameter	Over Eight Times Body Diameter
0.061	±0.007	±0.008	±0.010
0.089	±0.007	±0.008	±0.010
0.099	±0.007	±0.008	±0.010
0.123	±0.007	±0.010	±0.015
0.146	±0.010	±0.012	±0.015
0.188	±0.010	±0.012	±0.015
0.217	±0.010	±0.015	±0.020
0.252	±0.010	±0.015	±0.020
0.310	±0.010	±0.015	±0.020

Table 3—Maximum Fillet Radius

Nominal Rivet Size (inch)	Maximum Fillet Radius (inch)
0.061	0.008
0.089-0.099	0.012
0.123	0.016
0.146	0.020
0.188-0.217	0.025
0.252-0.310	0.030

Table 4—Dimensions of Oval-Head Semitubular Rivets

Nominal Size (inch)	Body Diameter (inch)	Head Diameter (inch)	Head Thickness (inch)	Head Radius (inch)	Taper Hole Rivets: Hole Diameter at End of Rivet* (inch)	Taper Hole Rivets: Hole Depth at Start of Apex* (inch)	Straight Hole Rivets: Hole Diameter at End of Rivet* (inch)	Straight Hole Rivets: Hole Depth at Start of Apex* (inch)
0.061	0.058-0.061	0.109±0.005	0.017±0.002	5/32	0.044	3/64	0.041	3/64
0.089	0.085-0.089	0.147±0.005	0.023±0.003	7/32	0.067	1/16	0.064	1/16
0.099	0.095-0.099	0.187±0.005	0.029±0.003	17/64	0.074	1/16	0.072	5/64
0.123	0.118-0.123	0.218±0.005	0.034±0.004	5/16	0.093	5/64	0.086	3/32
0.146	0.141-0.146	0.234±0.005	0.040±0.005	17/64	0.109	7/64	0.102	1/8
0.188	0.182-0.188	0.312±0.006	0.060±0.005	1/4	0.142	9/64	0.136	5/32
0.217	0.210-0.217	0.437±0.007	0.068±0.007	5/8	0.162	5/32	0.157	3/16
0.252	0.244-0.252	0.500±0.007	0.078±0.007	23/32	0.186	3/16	0.178	7/32
0.310	0.302-0.310	0.562±0.008	0.093±0.007	11/16	0.230	7/32	0.213	1/4

*These are reference dimensions only and will vary depending upon the purpose for which a particular rivet is designed.

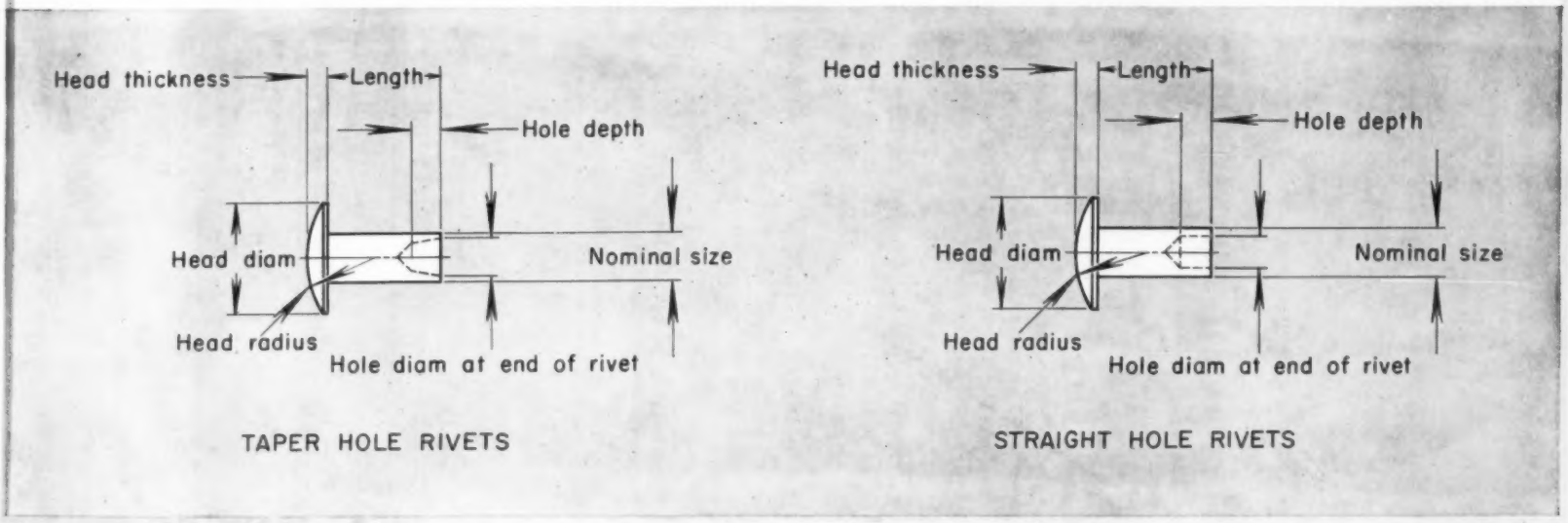


Table 5—Dimensions of Truss-Head Semitubular Rivets

Nominal Size (inch)	Body Diameter (inch)	Head Diameter (inch)	Head Thickness (inch)	Head Radius (inch)	Taper Hole Rivets		Straight Hole Rivets	
					Hole Diameter at End of Rivet* (inch)	Hole Depth at Start of Apex* (inch)	Hole Diameter at End of Rivet* (inch)	Hole Depth at Start of Apex* (inch)
0.061	0.058-0.061	0.125±0.005	0.017±0.002	1/8	0.044	3/64	0.041	3/64
0.089	0.085-0.089	0.187±0.005	0.023±0.003	7/32	0.067	1/16	0.064	1/16
0.123	0.118-0.123	0.281±0.005	0.034±0.004	3/8	0.093	5/64	0.086	3/32
0.146	0.141-0.146	0.312±0.006	0.040±0.005	29/64	0.109	7/64	0.102	1/8
0.188	0.182-0.188	0.375±0.006	0.060±0.005	17/32	0.142	9/64	0.136	5/32

*These are reference dimensions only and will vary depending upon the purpose for which a particular rivet is designed.

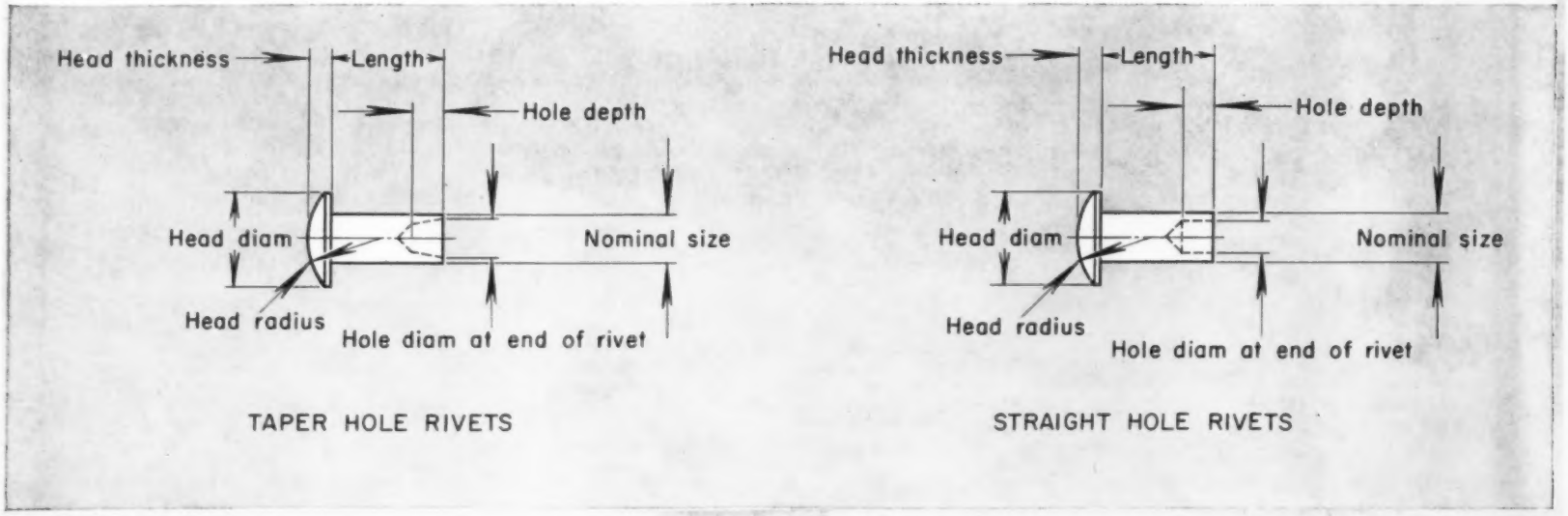
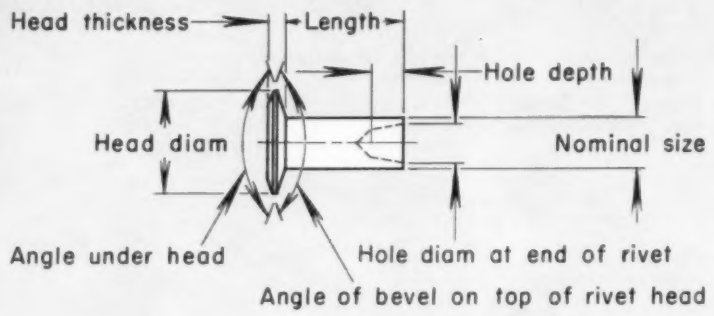


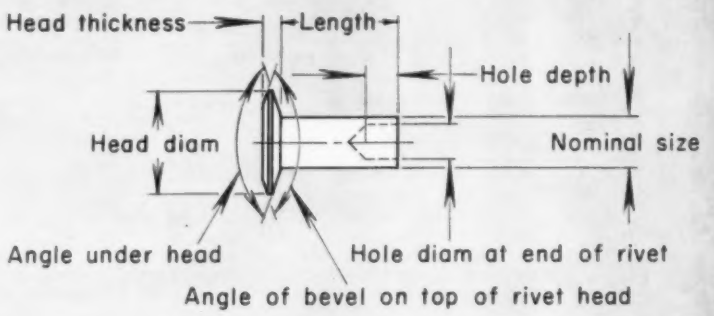
Table 6—Dimensions for Flat Countersunk-Head Semitubular Rivets

Nominal Size (inch)	Body Diameter (inch)	Head Diameter (inch)	Head Thickness (inch)	Included Angle under Head (degrees)	Included Angle of Bevel on Top of Head (degrees)	Taper Hole Rivets: Hole Diameter at End of Rivet* (inch)	Taper Hole Rivets: Hole Depth at Start of Apex* (inch)	Straight Hole Rivets: Hole Diameter at End of Rivet* (inch)	Straight Hole Rivets: Hole Depth at Start of Apex* (inch)
0.123	0.118-0.123	0.250±0.005	0.034±0.004	150	136	0.093	5/64	0.086	3/32
0.146	0.141-0.146	0.296±0.007	0.040±0.005	150	136	0.109	7/64	0.102	1/8
0.188	0.182-0.188	0.359±0.008	0.046±0.005	150	136	0.142	9/64	0.136	5/32
0.252	0.244-0.252	0.468±0.010	0.060±0.007	150	136	0.186	3/16	0.178	7/32
				Large Flat Countersunk-Head Semitubular Rivets					
0.146	0.141-0.146	0.359±0.008	0.046±0.005	150	136	0.109	7/64	0.102	1/8
0.188	0.182-0.188	0.468±0.010	0.063±0.005	150	136	0.142	9/64	0.136	5/32

*These are reference dimensions only and will vary depending upon the purpose for which a particular rivet is designed.



TAPER HOLE RIVETS



STRAIGHT HOLE RIVETS

ASTE news

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Members in the News



Hans Ernst

Internationally known research engineer, HANS ERNST has been appointed the first Herman Schneider research professor at the University of Cincinnati's college of engineering. Along with his duties at the university, Professor Ernst will continue to serve as research consultant at The Cincinnati Milling Machine Co., where he had been director of research for 32 years.

Dr. Howard K. Justice, UC engineering dean, said Ernst's duties would include "coordination and stimulation of research among faculty members and undergraduate and graduate engineering students, through the cooperative efforts of the university . . . and industry."

Ernst was born and educated in Australia. After four years of engineering design and teaching experience, he came to this continent during World War I. After service with the Royal Canadian Air Force, he did research and machine development work for eight years in Alton, Ill., and in 1926 joined Cincinnati Milling. After organizing that firm's research department, he directed its research and development for more than three decades. His first job at Cincinnati, the development of a hydraulic feed for a milling machine, resulted in the Hydromatic machine. In addition, more than 100 patents have been issued in Ernst's name. His paper, "Physics of Metal-Cutting," is regarded as the bible of the field.

In 1957 he received the first national research medal of the ASTE.

The new chair to which Professor Ernst has been named honors the late Dr. Herman Schneider, long dean of the university's engineering college and founder in 1906 of the now widely used Cincinnati plan of cooperative engineering education.

Greater New York chapter had to look no farther than its own membership for the recipient of its annual ASTE award. Presented to figures of national stature for outstanding contributions to both engineering and education, this year it was given to LOU WERTMAN, educational committee chairman and assistant professor at the New York City Community College. Wertman is also associated with New York University as coordinator of the manufacturing technology program, and has set up ASTE courses in automation, advanced tooling, pneumatics, estimating, tool and die design, etc.

A senior chapter member since 1949, he was appointed to his present ASTE post in 1953. It is in this position that Wertman has been one of the Society's most dynamic salesmen. Almost singlehandedly he has formed classes, set up programs, enlisted the services of experts in chosen fields, and at the same time has been responsible for the major portion of his classes' enrollment.



Lou Wertman



J. Clark Pierce

J. CLARK PIERCE has been appointed chief of tool and test control at Hughes Aircraft Co. in Tucson. He was formerly supervisor of tool control. With Hughes since 1951, Pierce is first vice chairman of Tucson chapter. . . . Dayton chapter's LOUIS F. POLK, vice president and group executive of Bendix Aviation Corp. and president of The Sheffield Corp., Dayton, was elected president of the American Ordnance Association at the group's recent annual meeting. The association is dedicated to assisting the nation's defense establishment in the solution of production engineering problems in all types of weapons systems. Polk is a member of the ASTE Research Fund Committee. . . . Carpenter Steel Co. has assigned THOMAS D. BURLEY, Pittsburgh chapter, as manager of the Reading, Pa., firm's high temperature steel sales. Burley has worked his way up from an order desk salesman in Cleveland, where he joined Carpenter in 1954. . . . Formerly with the Martin Co. in Baltimore, TONY FRIA has been promoted to manager of facilities planning, department of plant engineering, with Martin in Denver.



Milwaukee Schroeder Hotel, site of Leadership Conference and Annual Meeting.

Leadership Conference: Epidemic of Enthusiasm

WITH THE ARMY of narrators, moderators and other resource men they have assembled, the organizers of the ASTE Leadership conference in Milwaukee's Schroeder Hotel on April 18-19 have seen to it that no question on the part of the delegates concerning Society procedure will go unanswered. For by their questions they will be known. Known, that is, whether they have a sincere interest in the Society and whether they could eventually prove valuable as leader material on a national level.

Those in attendance—the newly elected chapter chairmen and, this year, the student chapter faculty advisors—will be in Milwaukee to ask questions and to learn the details of their responsibilities for an effective and productive administration. They will be there to cement a closer relationship between chapters, the national family and the national headquarters.

It is the primary objective of the program planners to indoctrinate the delegates through a barrage of pep-talks, discussion group meetings and conferences. And it is the duty of the fledgling chapter chairmen and the faculty advisors to absorb this information and pass it along to their members back home. The Leadership Conference might well be called a clinic, a clinic where an infection is caught, not cured—the infection being enthusiasm, and the carrier, the delegate, being judged by how well he spreads the germ in his local chapter.

Naturally, the conference will begin with an explanation of what it all means. It is a time for mutual exchange of ideas, a time for discussion, and a time for bringing into sharp focus the principles of leadership which must be exercised.

To gain a more intimate and informal atmosphere the large assembly will be broken into groups of 25 and a moderator. This is when real leadership will disclose itself. By free, unhampered group action leading personalities will be revealed. The moderators will be aware of this fact and will attempt to inject comments that will promote differences of opinion and add steam to the discussions. From those natural leaders who show themselves during these bull-sessions two men will be elected to represent the Blues and the Grays in quiz contests. The questions will concern subjects on which the delegates have already conferred. And the only way to come out on top is to keep one's ears open and grasp everything that is said.

Along with the special emphasis that will be placed on ASTE literature and the invaluable aid it can offer members as well as chairmen, there will be a whole session devoted to the Society's role in education. The conference will stress that tool engineering education(along with the promotion of adult education classes for those engineers wishing to supplement ther present knowledge, is a job that belongs to all dedicated Society members.

Each chapter will be reimbursed a sufficient amount for transportation and living quarters required by the visiting chairmen. The same procedure holds for student chapter advisors with only one difference. Reimbursement will be sent to the advisor rather than to the chapter. No expenses will be paid for the alternate delegates by the Society, unless they are serving as delegates.

This will be the third Leadership Conference, the first having taken place in 1953. Because of its great potential to the Society and its leaders, the conference was revived on an anuual basis last spring in Philadelphia.



Chapter #4 Host Committee for ASTE's 1959 Convention.

Milwaukee Host Committee

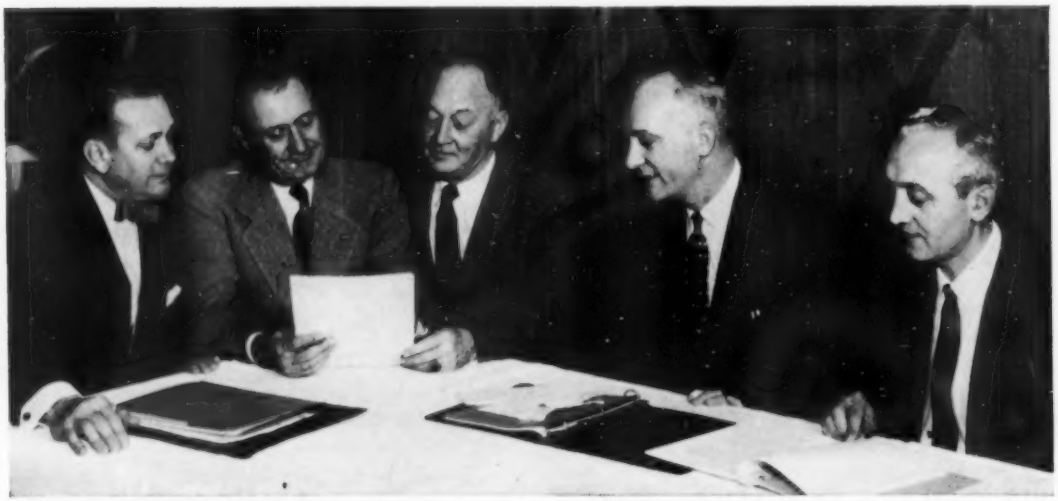
AN ASTE NEWS ITEM datelined April 19, 1958, and headed "Milwaukee Off to an Early Start," read as follows:

"The National Program Committee, under the chairmanship of Harry Paine, met April 10-11 at Milwaukee's Schroeder Hotel to discuss plans for the ASTE's 27th Annual Convention in 1959. Over 40 members of the Milwaukee Host Committee were on hand for the meeting to discuss their plans to work with NPC in assuring a successful convention.

"ASTE Vice President Dale Long congratulated the Milwaukee group for its enthusiasm in planning early . . ."

If work by the Host Committee is the principal determinant, the 1959 Annual Convention should be a real success. For now—on the eve of their big event—the Milwaukeeans are more dedicated than ever to the proposition that the convention, whose theme is "Planning for Profit," will indeed be a profitable experience for those attending.

The host chapter is one of the Society's pioneer units. Chapter #4, with a current membership of 502, began on April 2, 1936, with 43 members. The chairman of the chapter and of the Host Committee is L. A. Wacker, president and general manager of Sterling Tool & Mfg. Co.



Examining plans for the 1959 Convention in Milwaukee are the Host Committee officers: (left to right) L. A. Wacker, general chairman of the convention; Stephen Pohlhammer, Division A coordinator; George I. Riordan, convention vice chairman; Ralph L. Perlewitz, Division C coordinator and chapter second vice chairman; and Joseph Mundbrot, Division B coordinator and first vice chairman.

Evaluation of Metal-Cutting

literature is published

"And so I salute the workers in research as the poets of today. It may be that they do not write in verse, but they appeal to the imagination of us all. They contribute the warming glow of inspiration to industry, and when industry pulls its ideas down from the heavens to the earth and harnesses them for practical service, it too feels that it is an important factor, not only in the making of things, but on the larger stage of the human spirit. There may be enough poetry in the whir of our machines so that our machine age will become immortal."

These words are from a lecture by Owen D. Young on *"The Spirit of Shakespeare in Physical Research,"* delivered at the University of the State of New York during the 1930's, while Young was chairman of the board of General Electric.

Since Young's encomium, the world has indeed become full of such *"poets of today."* The heavens are clouded with ideas. There are so many floating around, in fact, that a practical man is hard pressed to pick out the ideas with silver linings.

One of the most pressing needs in all fields of research—especially in metals and metal cutting—is for an evaluation, a sorting out of good and bad ideas, so that the practical man can pull the right ones down to earth and the idea men can launch their new theories from a firm pad of facts.

It was with this need in mind that the ASTE initiated the significant *"research about research"* project described here.

RESULTS of step two of ASTE's largest single research project to date have just been published as Research Report No. 20. Entitled "An Evaluation of the Present Understanding of Metal Cutting," the 275-page book devolved from a two-year, $37,600 study made under ASTE contract by the Battelle Memorial Institute, one of the nation's largest research facilities.

Staff experts at Battelle waded through 12,000 original writings on the subject of metal cutting, plus untold numbers of rewritings and interpretations. The final evaluation sums up what this group, and a much larger group of competent reviewers from the industry, regard as the presently acceptable theories and practices of the metal-cutting art.

"We've attempted to throw away the chaff," said ASTE Research Director Leslie S. Fletcher. "We've tried to build a firm foundation for a realistic and integrated approach to future work, instead of the helter-skelter approach of the past.

"We think we've produced an important book."

The "Evaluation" is only a step, but a major step, in the Society's long-range program for metal-cutting research that could conceivably cost a million dollars—and could conceivably help industry to save billions. The next step in the over-all project will be decided by the metal-cutting project steering committee of the ASTE Research Fund, after the members have studied Battelle's report.

The authors, eight senior staff members of Battelle, say in their preface, "Machining operations are so widely employed and so basically important that the cost of metal cutting influences the price of almost every article of commerce. For this reason a considerable amount of research during the past 60 years has been devoted to the problems involved in cutting metals. Much of this effort has been of lasting benefit. Unfortunately, however, many investigations have stopped when questions on '*how* to produce particular parts' have been answered. There seems to be a disappointingly small volume of information on '*why* particular practices work' . . .

"The authors agree that present knowledge provides a reasonably detailed picture of the metal-cutting process as a sound basis for further studies leading to better materials and more economical cutting practices. There also seems to be little doubt that more widespread use of available information would result in appreciable improvements in cutting operations which now cost this country billions of dollars every year."

Battelle's first strategy in the project was to search the metal-cutting bibliography prepared by the John

Crerar Library (likewise an ASTE Research Fund project) and the older one prepared by O. W. Boston. Articles referred to in these bibliographies were screened, categorized and assigned to various committees of specialists. These groups considered the literature from the points of view of mechanical engineering, inorganic chemistry, physics, engineering physics, and metallurgy.

In addition to the literature studies, much information was gleaned from authorities by letter and by personal interviews.

All this information was sectionalized, analyzed, evaluated, and distilled, and the conflicting theories were reconciled or at least recognized. After review by senior Battelle staff members, the rough drafts were sent first to the ASTE steering committee for criticism, and then to reviewers around the country, people carefully selected for their knowledge of the field. Their comments were assessed and incorporated into the final report.

The final manuscript was authored by these Battelle staff members: F. W. Boulger, R. L. Carlson, S. L. Cosgrove, D. N. Gideon, R. W. Greenlee, H. J. Grover, Alfred Rudnick, and Ralph Simon.

Battelle, a nonprofit organization established about a quarter-century ago, expends some $15 million yearly on research, most of it sponsored by industry. The institute's large laboratories and library are located in Columbus, near the campus of Ohio State University.

Current members of the ASTE metal-cutting steering committee include: David N. Smith, research manager, Jones & Lamson Machine Co., Springfield, Vt.; E. M. Barber, research supervisor, Beacon Laboratories of The Texas Co., Beacon, N. Y.; F. J. Daasch, chief machinability engineer, Rock Island (Ill.) Arsenal Laboratory; Hans Ernst, University of Cincinnati professor, who is also research consultant for The Cincinnati Milling Machine Co.; E. L. Fowler of the R&D Div., International Nickel Co., Inc., New York; Dr. W. W. Gilbert, manager of machinability development, General Electric Co., Schenectady, N. Y.; Charles H. Good, plant manager, Micrometrical Development Corp., Ann Arbor, Mich.; E. J. Kaiser, staff vice president-manufacturing, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.; W. B. Kennedy, chief of experimental machining branch, Rodman Laboratory, Watertown (Mass.) Arsenal; Dr. William T. Lankford, chief research engineer, Specialty Products, U. S. Steel Corp., Pittsburgh; Dr. Daniel J. Martin, vice president-engineering, Hughes Tool Co., Houston, Tex.; John W. Molinar, general sales manager, Union Twist Drill Co., Athol, Mass.; Carl J. Oxford, Sr., vice president-engineering, National Twist Drill & Tool Co., Rochester, Mich.; George Pascoe, manager of Design & Standards Dept., Ford Motor Co., Dearborn, Mich.; Dr. George Roberts, vice president-technology, Vanadium Alloys Steel Co., Latrobe, Pa.; A. O. Schaefer, president of Pencoyd Steel & Forge Corp., Philadelphia; F. Forrest Stretmater, chief metallurgical engineer, Reynolds Metals Co., Richmond, Va.; Earle C. Smith, chief metallurgist, Republic Steel Corp., Cleveland; Jack Welch, division vice president, The Sheffield Corp., Dayton, Ohio; and Dr. M. Eugene Merchant, director of physical research, Cincinnati Milling.

Other Reports Published

Research Report No. 19, also recently published by the ASTE's Research Fund, is the result of a study at Massachusetts Institute of Technology on "The Cooling Characteristics of Cutting Fluids."

One of the salient and more startling conclusions reached by the three M.I.T. professors who conducted the two-year research project is that a coolant can be too good, resulting in shorter tool life. The fine-finish benefits of cutting fluids are controlled by tool temperature, the researchers found.

Although the tool man on the line has learned from practical experience that there are some cutting fluids that will produce a good job and some that will not, he hasn't known *why* such and such a fluid would not work. This 50-page report attempts to tell him why, and to demonstrate a reliable method of measuring the cooling characteristics of cutting fluids under actual cutting conditions. The essence of the study, which was made by Milton C. Shaw, Nathan H. Cook and Prescott A. Smith, is that it's always necessary to fit the cutting fluid to the particular job.

Dr. Shaw, a 1958 winner of the 1958 ASTE Gold Medal, is a member of the National Education Committee. He is head of the metals processing division of M.I.T.'s mechanical engineering department. Associate Professor Smith has long been prominent in ASTE affairs, having served as chairman of Chapter #33 and authored many technical papers for Society symposia. Cook is their colleague.

Four other research reports, Nos. 15 through 18, have resulted from the extensive plastic tooling research being conducted by the Purdue University Research Foundation under the auspices of the ASTE Research Fund. "Plastics for Tooling Bibliography" (No. 15) is an extension of a previous bibliography published a year before. "Linear Shrinkage Test Methods" (No. 16) and "Volumetric Shrinkage Test Methods" (No. 17) complete previous work done toward establishing two satisfactory methods for measuring plastic tooling shrinkage. "Impact Test Methods" (No. 18) is the initial study in the highly specialized and little-known field of impact resistance testing of plastics.

The Purdue projects are under the direction of Orville D. Lascoe, industrial engineering professor long active in national ASTE work.

The ASTE is getting big, so big that THE TOOL ENGINEER fears names will be buried by numbers. We don't want to lose sight of the fact that the Society, after all, is made up of some 39,000 individuals. To revive the intimate perspective—to look at the trees despite the forest—here's some news that's not national or regional, or even chapter level, but strictly personal. It's the fifth in a series of profiles of tool engineers.



Joseph N. Huser

Meet an ASTE Family

by **M. L. Stone**
news editor

JOE HUSER has four boys, and every last mother's son of them has turned out like his father—a good tool engineer and an unshirking ASTE member. That's one reason Joe is so proud.

There are other reasons. For instance, every one of them has also turned out to be, like Huser senior, a stalwart citizen in a city renowned for its good citizens. Country comes third only to family and God to the Husers; they live in a hotbed of Americanism, Indianapolis, and like it.

The ultimate test of whether an offspring is a success or a failure is whether he's a good or bad parent. Joe's sons have certainly turned out to be good fathers. Dedicated fathers, one might say. One son has seven children, two have five children each; the youngest has only one—but just give him time, says Joe.

Joe's also proud that his family can work as a team. Three of his sons hold down the top executive jobs at the firm Joe founded, and maintain a mutual respect for each other's abilities and responsibilities. In fact, Joe's willing to admit that once his boys



Executive conference at B & H Tool & Machine Corp. is a family affair. Here the Husers—John, Joe, Ray and papa Joe—gather around Ray's board in the engineering and design department.



Even though Joe Huser says his sons have taken over most of the work, he can't keep his hands entirely off tools. Here, for instance, he wields a screwdriver on his firm's Tel-a-patient, a specialty product which has endeared itself to impatient patients in doctors' offices. Dominating the scene is the nine-foot evidence of Joe's trip to Acapulco.

carried this teamwork thing to a pretty ridiculous length. A few years ago, three of the sons, John, Joe and Jim, presented their dad three new grandchildren within the space of eight hours.

"Grandpa is fit to be tied," John said at the time. All Joe Huser could say was "Teamwork, that's teamwork."

The mechanical genes have been pretty dominant in the Huser heredity, and Joe is currently wondering whether they'll shape his family on into the next generation. He thinks it's a likely prospect indeed that a good many of the 23 assorted grandchildren who have already been presented to him by his sons and two daughters will turn out to be tool engineers and members of Chapter 37.

"Probably some of them will end up taking over my business," said the genial white-haired family man with a grin, "like my boys."

The family's business is the B & H Tool & Machine Corp., a prospering new masonry plant situated on an uncrowded site along Massachusetts Avenue, just 4½ miles northeast of downtown Indianapolis' Monument Circle. Joe Huser—Joseph Nicholas Huser—was a cofounder of the company in 1936, and he's still president and manager.

"My boys, and my wife Carolyn, she's treasurer —they do the work," he said.

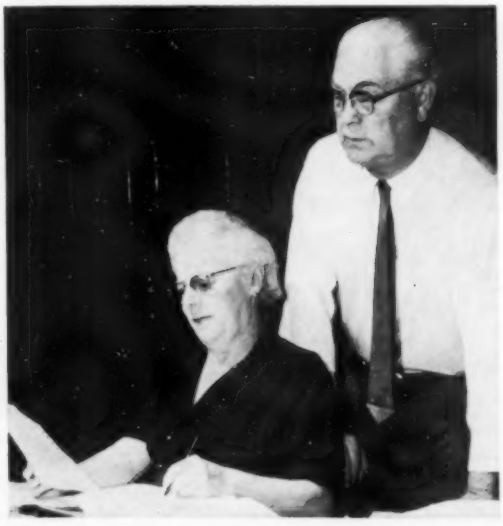
All the boys began at B & H on the handle of a broom, and advancement has been because of merit, not nepotism. Each served the full 8000-hour apprenticeship under the tutelage of either his dad or Harry A. Buses, cofounder and partner in the firm until he sold out to Joe and retired in 1945. Sons Joe, John and Ray now have complete control of the business operations at B & H, and have so successfully developed it that they were obliged to double their plant space two years ago. The firm was moved into the present $100,000 building in the fall of 1956, while father Huser was junketing around 14 European countries as a trade advisor to the U.S. Department of Commerce in his capacity as president of the National Tool and Die Manufacturers Association.

Quarterback With Backing

Here's the line-up of the people who "do the work" on the executive level at B & H, which is a sizeable 40-employee layout with 15,000 square feet of floor space devoted to the manufacture of fixtures, tools, gages, dies, jigs and aircraft specialties and with 1500 more square feet available for engineering and design.

Every team must have a quarterback, Joe is convinced, and son John, age 30, has been coolly calling the signals as assistant general manager, since 1950, and corporation secretary, since 1954. John, smooth and friendly but hard-driving, is a natural-born administrator who puts his "heart, head and shoulders" into things, according to Joe. An example of his drive was his wry recollection that his wife recently told him he was staying home for the first evening in 44 days running.

Another example of John's verve is his activity in the ASTE. He joined in March, 1952, and immediately took on committee assignments that led, by 1956-57, to the chapter chairmanship. He served as a member of the advisory committee of the In-



Firm's treasurer, Carolyn Huser, checks up on Joe's business while he checks up on his wife.

diana Council of ASTE from 1954 to 1958, and is now a member of the National Program Committee. He is active in various civic and parish organizations, has four sons of his own and a baby daughter, and also has found time to design and subcontract the homes he and his father live in.

But a good quarterback is no good without backing. Perhaps the mainstay of B & H is eldest son Joe—Joseph Leo—age 33, intense, thoughtful, already graying like all the boys. He is shop superintendent and vice president of the corporation.

The younger Joe, who handles personnel at the plant, is interested in people as well as personnel. He is proud of his shop's safety record, but is realistic enough to admit that "you can make a machine foolproof but you can't make it idiotproof." He pointed out the oldest employee—at B & H for 20 years—and called attention to the liberal supply of vending machines that solved his perennial rest period problem, and to the unique ray-heating system he had installed on the ceiling of the shop, which creates islands of thermostatically controlled air. He recalled having to lay off 15 people last fall—"hardest thing I've ever done."

The superintendent is proud of his shop's apprenticeship program (which is racially integrated, by the way) and of his shop's modern equipment, with only two machines more than ten years old.

"Dad gives me a free hand on buying decisions which I probably wouldn't have in a company where each administrative department is working not so much for the common goal of the firm but more for the selfish goal of reflecting credit on the separate departments. Here, it's all in the family."

Joe junior is also proud of the fact that there's only one foreign machine, a lathe, in his shop—and it was forced on them in a production emergency, he said. He is peeved about the auto companies placing their tooling orders in Europe and, as a veteran, is bitter that U.S. tax dollars which were used to put foreign countries on their feet are now being used as weapons against us.

"I'm not one to sneer at this America first idea," he said. "If we don't put America first, who else will?"

Young Joe is now vice president of the Indiana Tool and Die Manufacturers Association.

Youngest son Ray, christened Robert Raymond, is assistant foreman and also a cheerful and likable vice president at the age of 27. He began his apprenticeship training in 1947, when he was hired like his three brothers before him by his father's firm, then called the B & H Specialty Co. He first joined the ASTE as a student member of Chapter 37, while taking engineering at Purdue University.

An "outsider" in only a narrow sense of the word—the fact that he doesn't work in the family firm—is Jim, foreman of a competitive tool shop in Indianapolis and "the best tool engineer of the whole lot of us," according to brother John.



Son Joe Huser, shop superintendent, gazes reflectively at his machines from within his glassed cubicle.

The only concession the father made to his boys' inexperience when he was forced by illness to turn over the main wheels to them was to hire an old ASTE friend and capable tool engineer, John E. Horton, as chief engineer. Horton came to B & H from the presidency of the Precision Engineering Co. and years of experience with Indiana and New Jersey firms.

Three Past Chairmen in Plant

With Horton on the payroll, B & H can claim quite a distinction in ASTE circles. There are three men in the plant who are past chapter chairmen—first of all, the elder Joe, who was at the Indianapolis chapter helm in 1944-45; Horton himself; and John Huser.

Horton, an active ASTE member for two decades and a charter member of Chapter 34 in the New York-New Jersey area, has only one axe to grind, and that one's altruistic. He is on a crusade to get the national Society to keep its retired tool engineers on mailing lists free of charge. "Dollars mean a lot to people when they get to the point where it's all outgo and no income," he said. "Such a gesture by the ASTE would be more than worth the cost because of the good will and real advisory benefits that would accrue to the Society."

But still very much president of the firm, despite



John Huser and firm's chief engineer, John Horton, left, pore over drawings in Horton's office at B & H.

what he says about letting the youngsters do the work, is Joe Huser himself. He shows up at his desk every day, keeping one eye on the nine-foot-long sailfish he caught off Acapulco and one fatherly and husbandly eye on what his family is doing with his business.

Joe's basic philosophy in his business is that there's strength in diversity. Last year, his plant's billings showed over a hundred customers. He'll admit that some shops with only three or four big customers are doing just as well or better than his, but they're more likely to suffer in recessions—and they don't have nearly as many friends.

Prefers Soul to Pot of Gold

"We don't ever take a prime contract, and we don't want one," he said. "We've had several offers over the years from some of our customers, big companies, wanting to take us over, use all our shop time. No go. We've built up a lot of friends by giving them consideration and quality products. We don't intend to sell our soul of service and responsibility for any pot of gold."

Joe is an organization man. He believes quite strongly, though, that the benefits a member gets from an organization are in direct ratio to the benefits the organization gets from the member. So he works at his memberships.

Besides his ASTE chapter posts, he was the organizer and first president of the Indiana Tool & Die Manufacturers Association in 1945. During the same year he was active in the War Production Clinic for the solution of manufacturing problems, and was serving on the advisory committee of the metalworking industry of the Indianapolis Credit Men's Association.

For the past nine years he has been a trustee of the NTDMA, and went up the ladder to national president in 1955.

During the Korean war he was on the tool and die industrial advisory committee of both the OPS and the NPA. For the yast two years, since before his mission in Europe, he has been on the like-named committee of the Commerce Department. He is also past commander of an American Legion post in Indianapolis, and a civic and church leader who was the main force behind a $12-million hospital fund drive recently.

Joe began his career in tools in 1919, being employed by the Wheeler-Schebler Carburetor Co. Later, for 11 years, he was chief inspector and new equipment trouble shooter for the Insley Manufacturing Corp. He and shop superintendent Harry Buses left Insley in 1936 and formed the B & H Specialty Co. with only $200 between them.

They built their business, as the original company name indicates, on specialties. Foremost was an ingenious little device called a Tel-a-patient, which they made for doctors and dentists. It's an illuminated plastic box which says on occasion, "In, Please Be Seated," or "Out, Will Return At (such and such a time)."

Another colorful accomplishment of the flourishing young firm was the development of a microfilm camera with a new gimmick—an electronic control that gives correct exposures automatically, no matter the shading of the paper being photographed. With the integral gadget, called Electron-X, it's possible to photograph by moonlight—and with no hands.

The Husers still have the camera angle very much in mind. Now that bugs are ironed out, their problem is distribution. John went to a Chicago camera show last month to assess the feasibility of marketing their camera for $6000 or so in a field where competitive products now cost $10,000 up.

Finally, there's Carolyn, treasurer. How much credit does Joe give his wife for her part in helping mold the remarkably close-knit and productive family relationship that adds new dimensions to the old word teamwork?

"Well, in this family's corporation, the mother owns 51 percent of the stock," Joe replied carefully as Carolyn figured away at her desk. "Figuratively if not literally."



Huser family's present plant, built and occupied in the fall of 1956. Old plant was a few blocks away.

Student Loan Funds Set Up

ESTABLISHMENT of student loan funds by two more ASTE chapters is just another step in strengthening the bond between the Society and its eventual source of strength—the colleges and technical institutes.

The early part of 1958 saw the institution of a loan fund by the Buffalo chapter. Evidently this chapter started a trend, for now Worcester and Dayton have acted similarly.

The Worcester chapter's new loan plan allows for $500 to be distributed as seen fit by each of two schools: Worcester Polytechnic Institute and Worcester Junior College. The student need not pay interest while attending school, but with completion of his studies and subsequent employment a slight fee will be charged. A student loan committee has been formed to administer the money for distribution to the schools through the chapter education committee.

Worcester chapter will also award several prizes for outstanding projects completed in some phase of mechanical engineering, preferably tool engineering. At W.P.I. there will be a cash award of $50 for the top project; $25 and two ASTE handbooks will go to the chosen students at W.J.C.

A loan fund of a somewhat different nature has been adopted by the Dayton chapter. To be effective at Sinclair College, the fund will provide 50 percent of the expenses and tuition of any qualified student for one term only. No interest will be charged but the loan must be repaid within two years of the date of issuance. The committee set up to handle the loan consists of three active chapter members, their terms running one for three years, another for two years, and the last for one year.

As in any plan designed to accommodate worthy students, the prospective recipients will be screened carefully. Scholastically they must be above average and financially in real need of assistance. Of course, those selected must possess more than a passing interest in the tool engineering field. For, not only were the loan funds set up to aid students financially, but perhaps influence them somewhat when the time comes to choose a specific field of engineering.

Chapter Honors Area Teachers

PRESENTATION of *Tool Engineer Handbook* to the principals of 11 high schools in the Northern Massachusetts chapter area introduced a new and significant educational award system, one which other chapters who have limited resources and limited opportunities for developing good educational programs might do well to note.

The recipients of the awards were school heads who had given special aid to the chapter's scholarship selections. Chapter First Vice Chairman Herman A. Wojdylak gave the books to the principals in the hope that they would place them in the school libraries to introduce students to tool engineering and also to help teachers better understand the field.

Another undertaking adding to the prestige of the Society was the first presentation of the Science Teacher Award, this year the award going to M. Ross Burns of Greenfield High School. In order to qualify for this honor Burns proved himself the teacher in that area who had contributed the most to the development of his students' interest in the sciences.

"The Future of the Free World" was the topic of a talk given at the same meeting by Lado A. Kozely, professor of law and economics at Assumption College, Worcester, Mass., and former Yugoslav freedom fighter at the time of the Nazi invasion.

Dr. Kozely warned Americans not to take free enterprise for granted. "We must face the challenge of that nation which would destroy our way of life."



Pictured at the special Nov. 18 meeting are (seated) Prof. Lado A. Kozely and George A. Stanley, Jr., chapter chairman; (standing) John W. Turton, second vice-chairman; Principal George M. Leonard, Pioneer Valley Regional School; M. Ross Burns; and Edward A. Miller, assistant manager, Greenfield Tap & Die.

chapter news and views

Chapter #148 Views Vickers Operations



CENTRAL CONNECTICUT—Anthony Polman examines a part machined on a New Britain Model #219 tracer lathe during his chapter's tour of the Waterbury plant of Vickers, Inc. Looking on is Edward Lango of the Vickers staff. Part is traced after normalizing. One cut required one-eight-inch depth allowing stock for finish grinding.

Looking at display of various products of the Waterbury Tool Co. plant of Vickers, Inc., are (left to right) George Fifield, Vito Lapio, Steve Stamates, Robert Geiger, Less Partiss of the plant staff, D. E. Harris, and Ray Morris, past national president of ASTE, forty-five members of Chapter #148, from Waterbury, Torrington, Winsted, Bristol and nearby cities, turned out to view facilities of a plant engaged in exacting engineering and lubrication of hydraulic pumps, valves and missile parts. James Galimberti, project engineer in charge of metal-cutting research at Kennametal Co., spoke to 118 members at technical meeting that followed the tour.



Plastics in Tooling Conference Planned

CHICAGO—A "Plastics in Tooling" conference, jointly sponsored by the ASTE and the Society of the Plastics Industry, has been set for Feb. 2 at the Edgewater Beach Hotel, Chicago. The tooling conference was arranged so that SPI members who will be attending that group's Reinforced Plastics Division conference next day might include the joint affair on their schedule.

Keystone

From a dredging company on the Yuba River in California to a plant engaged in the manufacture of heat exchangers for atomic reactors . . . This is the history of the Yuba Corp. of Consolidated Industries, as related at Keystone chapter's Dec. 15 meeting by Robert Maxwell, consulting engineer. Meeting and plant tour were at Honesdale, Pa.

Melbourne Becomes Second "Down-Under" Chapter of Society

MELBOURNE—Another step in the growth of ASTE was taken in this Australian city Nov. 28, 1958, when Chapter #152 was guided into the fold, thus increasing the number of overseas chapters to two.

Letters and cables of congratulations highlighted the chartering along with a recorded welcome by Society President George A. Goodwin. Also among the well-wishers who could not attend but who acknowledged the event were: the premier of Victoria, the Australian minister of labor, the president of the Institute of Production Engineers, and the principal of the Royal Melbourne Technical College. Guests included C. Curtiss and D. Corbett, president and secretary of the Sydney chapter; V. Penner of the Toronto chapter; and W. Bickers of the Ford Motor Co., Canada.

The seed which eventually bloomed into this full-fledged chapter was planted in January of 1958 at a meeting held at the Sheffield Corp. It was decided at this meeting that an organizing committee be appointed to ascertain the needs and problems associated with the formation of another chapter in Australia. Attending the meeting was Frank Ritchie of the Society's National Public Relations Committee and managing director of the Ford Motor Co., Canada. Ritchie was back in Australia to act as chartering officer and perform the swearing-in ceremonies at the chartering in Melbourne.

Elected for the organizing committee at the initial meeting were: R. Chaney, chairman; D. Webster, first vice chairman; E. Gibson, second vice chairman; J. Duncan, third vice chairman; E. J. Headland, secretary; and N. Dalton, treasurer. The same men are still serving in these capacities pro tem, until February elections.

The strength of the Melbourne group already has grown to 132 members. Its Australian counterpart in Sydney, also thriving, was formally chartered on March 26, 1957.

Mansfield

"Ceramics, Tomorrow's Cutters Today" was the subject of a talk given by Robert T. Hook, chief metallurgist for Warner & Swasey Co. Hook pointed out that ceramics have the possibilities to meet the demand for higher production rates. Development has disclosed many amazing feats in feed, speed and finish. Ohio State University films on ceramics were shown cutting a forged steel casting at 16,000 sfm.



UTAH STATE UNIVERSITY—Participating in a tool show sponsored by the Salt Lake chapter, USU student chapter set up a booth displaying the facilities available in their labs. Left to right are Dell Johnson, McKinley Thomas, Loyal Anderson, and Robert Wallentine, who set up the booth.



LOS ANGELES—Taking part in the panel discussion at the November chapter meeting were (from left) Donald Marlin, Ryan Aircraft Co.; Donald Stafford, Apco; Gordon Salter, J. J. Foster Co.; Harold Bloom, North American Aviation; and Calvin Kindschi, program chairman. Main topic of discussion was bonded honeycomb structures, which are currently presenting a major production problem to tool engineers and are also becoming of great importance in the missile development race.

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Guest speaker T. W. Black (left) congratulates the winners of Twin Cities scholarships: (from left) Harold E. Kastens, Harold C. Dhont, William C. Summers, and Peter Recht. Robert Rodby, chapter education chairman, is at right.

Scholarship Awards, Editor's Talk Mark Twin Cities Meeting

TWIN CITIES—Receiving a scholarship, while certainly aiding the student financially, also has a reassuring effect on him, the knowledge that he is attending an institution which is being recognized by a professional society such as the ASTE gives him confidence. This comment by one of those present at the December meeting of the Twin Cities chapter was prompted by the presentation of four $100 scholarships to students from various schools in the chapter area.

Selected for awards on the basis of their scholarship, proficiency in their work, punctuality, attendance, and general attitude were: Harold C. Dhont, Minneapolis Vocational School; Harold E. Kastens, St. Paul Vocational School; Peter Recht, Dunwoody Industrial Institute; and William C. Summers, University of Minnesota. This is the fifth successive year that the Twin Cities chapter has taken the opportunity, through the presentation of scholarships, to recognize institutions and encourage students to follow a career in tool engineering.

T. W. Black, senior associate editor of THE TOOL ENGINEER, in a talk on "Trends in Tool Engineering," said "we are now in an age of explosive technical development. This development has been kindled by the tremendous amount of technical literature that is available to the engineer. In other words, we stand on the shoulders of those who have gone before." Realizing the difficulty the engineer has in keeping abreast of the times, Black suggested one remedy for this—and, at the same time, got in a plug for his magazine. Read THE TOOL ENGINEER, he said.

—David W. Johnson



LIMA—Present at the illustrated talk given by C. G. Schelly on "The Cutting Edge" were (from left) Chapter Education Chairman Ken Rice and Harry Davis and Ohlin Hablitzel, instructors at Van Wert High School.

Merrimack Valley Hears New Method Of Teaching Physics

MERRIMACK VALLEY—"The best class is the one that begins when it ends." This rather paradoxical statement was made by Elbert Payson Little, executive director of the physical science study committee, Massachusetts Institute of Technology.

Addressing ASTE members and high school science teachers invited from the Merrimack Valley area, Dr. Little explained a new method of teaching high school physics which has captured the minds of ordinarily reluctant students. This new technique, which lets the youngsters take an active part in laboratory experiments and also lets them build their own recording instruments so they may better understand what they are doing and why, has aroused an enthusiasm in the students which heretofore was nonexistent.

Little explained this phenomenon: "By performing projects yourself, you know and believe in what you are doing.

"With this new method of teaching, students stay after school to learn more and then take it home with them," he added.

Another highlight of this Dec. 4 meeting was the inauguration of the first annual Father and Son's night.

—D. J. Patti



SANTA ANA VALLEY—Ray Gariss (left), representing the national technical publications committee, presented special Order of Merit awards to James Rust (center), chairman, Santa Ana chapter; and Ray Journeay, chapter secretary, for their help in making the Western Tool Show a success.

San Fernando Hears Problems of Tooling For Rocket Engines

SAN FERNANDO—Eighty members heard Clifford Kennedy, general supervisor of tool design for Rocketdyne Div. of North American Aviation, Inc., talk on tooling for rocket engines. Kennedy divided the typical large rocket engine into five major components and told of some of the problems of their construction: (1) turbine and pumping system; (2) gas generation system to supply the motive power to the turbine; (3) fuel and liquid oxygen injector; (4) thrust chamber; and (5) miscellaneous valves.

The gas generator injector is by far the most difficult to make, Kennedy said, because this injector may have as many as 3000 holes that must shoot a stream of fuel to a theoretical point within ± 0.001 in. These holes are a real problem, he said, for as yet no manufacturer of drills has a package of drills from #30 to #60 that will consistently drill holes to a tolerance of ± 0.005 on diameter and give a reamed finish without reaming.

Kennedy emphasized the extreme need for drills to do this kind of job for many of the rocket engine builders.

—Art Hunter

Members Speak Up At St. Louis Session

ST. LOUIS—A panel with Assistant Prof. Thomas J. Holladay of Washington University presiding was the highlight of the Nov. 6 meeting of St. Louis chapter.

The speakers, members of Chapter #7, were allowed ten minutes to expound on their chosen topics. Bernard McLaughlin, chief tool engineer at the White Rodgers Electric Co., enlightened the audience on "Manufacturing Processes," as did likewise Willis J. Potthoff, chairman of the National Technical Publications Committee and supervisor, Emerson Electric Co., speaking of the "Specifications for Good Tooling." A joint discussion of "Heat Treating and Metal Finishing" was presented by John S. Skoglund, plant manager at Lindberg Steel Treating Co., Inc., and Harold Thieffer, Metallurgist for Paulo Products. Herman Zimmerman, Danly Machine Specialty Co., and Emmet J. Fink, supervisor of tool design at Mc Donnell Aircraft Corp., spoke respectively on "Die Design" and "Tool Design." Emil Labanics, vice president of production, St. Louis Diecasting Corp., rounded out the program with an explanation of "Diecasting" as it is today.

—Lyle R. Perry



Studying the findings of the electronic computer are (left to right) Donald S. Whitney, computer programmer for Fellows Gear Shaper Co.; the chapter secretary, Benjamin Bloomfield, who is engineer in charge of the Fellows computer; and Raymond Walls, guest speaker.

Santa Ana Valley Hears Atlas Expert

SANTA ANA VALLEY—With the successful launching of the Atlas missile, L. G. Grandstedt, chief tool engineer for Convair Astronautics, San Diego, Calif., could have selected no more timely subject for his address to the Santa Ana Valley chapter.

Grandstedt accompanied a talk on "Tooling the Atlas" with films of a launching and slides of various brazing and welding machines especially designed to fabricate the missile. He emphasized the extensive use of optical tooling in the Atlas. In working K-monel, used because of its ability to withstand a wide temperature range, the engineer said it was found that by lowering the temperature of skin sheets to —90 degrees, they formed more easily.

—Robert C. Gordon



Chapter Program Chairman Ray Crouch (left) talks with guest speaker L. G. Grandstedt, whose topic at Santa Ana Valley meeting was "Tooling the Atlas."

Computer Demonstrated To Twin States Chapter

TWIN STATES—The growth of the electronic digital computer's role in industry was outlined at the Twin States chapter's December meeting by Raymond Walls, sales engineer, Bendix Computer Div. The meeting was held at the Fellows Gear Shaper Co.

Walls explained how a typical mathematical problem could be programmed and solved by it. He used a new simplified programming system to set up the problem for the computer. The problem was then solved correctly.

Neal L. Cobb, chief engineer of Fellows, spoke briefly on the uses of the computer in the engineering department of his company.

—Bernard W. Harriman

Sargent Represents ASTE at Inauguration

Past National President Al M. Sargent was the Society's official representative at the inauguration of Wesley Powell as governor of New Hampshire, in ceremonies on Jan. 8 at the State House, Concord.

Sargent, a charter member of the Society with a long record of chapter and national activities, is a Detroit consulting engineer. He was ASTE president in 1946-47.



Robert S. Morrow, first vice chairman and program committee chairman, talks with guest speaker, Dr. Leo T. Doherty, at Worcester's annual Industry and Education meeting.

New Focus for Education Revealed at Worcester

WORCESTER—Facing the storm of protests which have arisen against the American educational system recently, Dr. Leo T. Doherty, superintendent of Worcester schools, voiced the opinion that educational standards are not slipping, but are actually higher than ever. The occasion was Worcester chapter's Industry and Education night.

Interesting support for Doherty's theory was found in his revelation that half the men who attended Harvard before 1951 would not gain admittance today. He also stated that where technological lags do exist they are already being remedied with the installation of technical libraries in high schools, the formation of advance study groups for bright students, and greater cooperation between high school and college instructors in determining where weak points in the secondary schools lie and how they can be dealt with.

Doherty concluded that setting our sights on higher educational standards will prove futile if parental assistance is not gained. Taking an interest in their child's future, helping him to learn and maintain proper study habits and, too, cooperating with the educators in every way are all part of the vital role parents must play if we are to keep our country and our schools strong. —*Robert A. Cusson*

San Francisco

At the Nov. 20 technical meeting Ted J. Rohrer, sales engineer for Pratt & Whitney Co., and past chairman of Golden Gate chapter, spoke to 65 members on "New Developments and Applications in Gaging," pointing out 15 new gage techniques. Two films, "Accent on Accuracy" and "Breaking the Gaging Bottleneck," were shown.

Student Member Spells Out 'What Is Expected of You'

A student member of Long Island chapter, John M. Castro, Jr., recently wrote Editor John W. Greve of THE TOOL ENGINEER:

"A while back, I received a printed letter asking ASTE members to submit any kind of information that might benefit other ASTE members.

"Well, since I'm still going to school here at Farmingdale, N. Y., and my experience in new or unique methods or developments is still very limited, I wrote an essay on what I feel a professional society can do for an individual.

"I speak for all the members of my class as well as for myself when I say that we have found THE TOOL ENGINEER a vital aid to our studies."

Here is John's essay, entitled "It Is Expected of You":

As a citizen, a man is expected to vote; as a father, he is expected to spend time with his wife and children; and as a provider, he is expected to hold a job, and get ahead in it. These things make up today's modern society, and they are expected of every man.

True, the task of getting ahead on the job requires a great deal of effort, but social status in the United States depends largely on one's position in his particular field of endeavor, whether it be a profession, a trade, or common labor.

A professional society can be of great value to the man who takes his job seriously, and is interested in the latest advancements made in his field. It keeps him up to date. He is continually being educated, which in turn makes him more valuable to his company and his boss.

Active membership enables the individual to meet the men in his field. Men who can help him with his problems, or men who are influential enough to help him up the ladder of success. Men he never would have met, had it not been for the society-sponsored meetings, conventions, and recreational activities.

The chances of gaining recognition are increased. As a member, he is looked upon as "one of the boys." He's rewarded for outstanding accomplishments in his field. He is given responsible positions, which in turn make him a credit to his family and his community.

A professional society is capable of doing these things for its members, but it can only be as beneficial as its members make it. So take pride in participating in all of its activities because, just like your civic duties, it is expected of you!

Monmouth

An expected attendance of 50 members increased to 101 members and guests, including six from the Philadelphia chapter, for the plant tour of Adamas Carbide Corp. Nov. 11.



INDIANAPOLIS—H. D. "Pop" Hiatt holds the Award of Merit plaque, one of eight such national honor awards given for outstanding contributions to ASTE on the chapter level. The presentation was made by ASTE Vice President Dale Long, left, and National Director Cecil Chapman, right. Far right is Chapter Chairman Roy Erickson. Hiatt is a charter member and past chairman of the Indianapolis chapter. —*C.J.Myers*

Philadelphia Speaker Terms Teamwork Key to U. S. Success

PHILADELPHIA—What makes American industry competitive in foreign markets with their lower wages and comparable technology? According to George J. Meyers, Jr., executive vice-president of the Reading Tube Corp., Reading, Pa., it is the American concept of teamwork.

Appearing at the November meeting of Philadelphia chapter, Meyers talked on "This Is Our Industrial Philosophy." An industrial philosophy based on teamwork and morality is something rather new on what Meyers called "the ideological firing line." It is valuable not only from the standpoint of greater company efficiency but from an individual and community standpoint as well. Through the company it carries over into the personal life of the individual and ultimately affects the community.

Meyers explained the over-all objective of such a philosophy is to promote not only leadership in industry and the immediate community, but also leadership in the nation. —*Jerry Weiland*

Balance and Unbalance Described by Schmidt

ELMIRA—Using a film to clarify his topic, William G. Schmidt, sales manager of Gisholt Machine Co., described the nature of balancing at the Dec. 1 chapter meeting. Schmidt stated that all rotary balance falls into two categories: force and moment unbalance and static and dynamic balancing. Force unbalance is common to a single plane and is detected and corrected by static balancing. Moment unbalance is associated with multiple planes. This unbalance causes wobble and is detected and corrected by dynamic balancing.

During the question and answer period which followed, Schmidt adapted these principles to individual problems, and explained several methods used to find the amount and point of unbalance. —*Peter Doll*

Northern Massachusetts

Richard L. Rouviere, regional sales manager of Devcon Corp., spoke at the monthly technical meeting with 55 members present. In his talk, "Basic Uses of Plastic Casting Resins in Everyday Tooling," he described the many applications of both the liquid and putty types of resins, ranging from the making of large dies to the repairing of a leak in a tank.



Guest speaker George J. Meyers, Jr. (center) stresses a point of his talk with Chairman Harland O. Fullman (left), of the C. H. Wheeler Co., and M. Richard Carpenter, Standard Pressed Steel Co., who is program committee chairman at Philadelphia.

San Francisco Group Tours Shipyard

SAN FRANCISCO—One of the most fertile fields for creativity in tool engineering is in naval shipyard operations, where the large dimensions of U.S. vessels make it impossible to use standard tooling methods and where no two jobs are alike.

This was amply illustrated to 170 San Francisco chapter members at the U.S. Naval Shipyard there by their host and guide, Richard E. Meyers, department head of the yard's value engineering branch. Meyers showed the touring ASTE group many of the innovations that have been worked out by their fellow tool engineers during the shipyard's illustrious 18-year history.

Meyers, an ASTE member himself and a contributor to THE TOOL ENGINEER on functional drafting, said that several conclusions had been drawn as a result of experiences at the mammoth shipyard:

1. Machining in place is the most accurate method and insures the best alignment.
2. The use of optics and the tooling clip concept is sound and establishes practical accuracy for all machining and aligning operations.
3. Metal removal rates for portable tooling can rival other processes if tools are properly designed and built.
4. Built-in accuracy in tooling results in finished accuracy.
5. Practical and ingenious tool engineering pays off in a better job at lower cost.

The visitors saw a special welding alignment procedure that is being used on a catapult job. Many of its components are successfully used for other foundation milling work, Meyers said.

He cited the yard's wartime record of 209 ships serviced and 661 drydocked for overhaul, and declared that the complete tool, machinery, and shop facilities make it one of the Navy's Class A installations.

Even though the shipyard tool engineers must be jacks-of-all-trades, Meyers, said, they must still call on sales engineers and others from private industry for help in their special tooling problems. —*Chester L. Norton*

Elmira

At the November meeting Walter Peterson of the Forging and Casting Div. of Allegheny Ludlum spoke of some of the unusual ways tool steel castings are being used in forming dies. Longer die life results, Peterson explained, due to the more homogeneous grain structure in castings lending itself to better lubrication with oils penetrating the surface. Henry Fleig of Brace-Mueller-Huntly showed films on the manufacture of Huron tool steel and the processing of carbide for tool applications. Special note was taken of the extreme caution used throughout the process in the mixing of the powdered materials, allowances for shrinkage, presintering bake, trimming and final sintering.

chips and chatter

Schuylkill Valley

Twenty-nine members made a trip to Allentown to attend the third annual joint meeting of the Lehigh Valley and Schuylkill Valley chapters. In his talk, "Missiles, Metallurgy and Machining," Malcolm Faulkner Judkins, director of New Products Development, Firth Sterling, Inc., discussed the multiplication of problems caused by hypersonic flight through the earth's atmosphere and the use of alloyed metals and refractories, such as ceramics.

Phoenix

On Nov. 10, the chapter visited Motorola Semiconductor Products Div., where 43 members were shown the complex operations of transistor manufacturing from refining germanium to the electrical testing of the finished transistor. The highlight of the evening was a talk on "Materials Selection and Manufacturing Problems of Semiconductor Products," given by Don Dickson, product manager for Diodes.

University of Kansas

At the kickoff meeting, L. B. Musser of Bendix Aviation Corp. addressed a capacity crowd of members and prospective members on "Numerical Control System."

Instead of the regular meeting during the month of October, a field trip was taken to the Locomotive Finishing Materials Div. of Rockwell Mfg. Corp., Atchison, Kan., where each operation was explained to small groups by staff members.

NW Pennsylvania

The manufacture of steel, from ores to the finished products, was the subject of a talk given to 60 chapter members at the Dec. 4 meeting. Robert N. McGee, special sales representative of the Jones & Laughlin Steel Corp., Pittsburgh, was guest speaker.



ATLANTA—Dr. William A. Calder, professor of physics and astronomy at Agnes Scott College in Atlanta, was a recent lecturer before Chapter #61 members on space flight. —*L. C. Volberding*

Kansas City

At the Nov. 19 meeting 58 members and guests heard Donald A. Trescott, vice president of Super-Cut, Inc., showed a color sound film on diamond mining, completed in South Africa in 1954, and compared old mining methods with the most advanced. The film portrayed material excavation, crushing, separation of diamonds, sorting, recovery and industrial applications.

Golden Gate

At a joint technical meeting with San Francisco, 147 members and guests heard Carl J. Oxford, director of research at the National Twist Drill Co., speak on "Modern Drills and Drilling Techniques." An ASTE international scholarship award was presented to Student Member Robert Menzies of the San Francisco chapter, by Carl Kaiser of the national education committee.

Western Reserve

Thirty-four persons heard H. A. Daschner, managing director of Pressed Metal Institute, speak at the Nov. 25 meeting. In his talk, "New Horizons in Metal Stamping," Daschner presented many new and interesting techniques in metal stamping and suggested a freer exchange of ideas in the metal stamping industry.

Cincinnati

M. R. Prather, vice president of The Cincinnati Diecasting Co., narrated a colored movie entitled "Diecast—How Else Would You Make It?" The film illustrated the diecasting method of producing complex castings of zinc and aluminum at high speed, and also drew a comparison between shell molding investment casting and powdered metal processes.

Obituaries

John J. Dean, Jr., Piedmont, development engineer, Western Electric Co.

Maynard L. Foskett, Kalamazoo, assistant to vice president, Clareage Fan Co.

Thomas J. Fraser, Cleveland, president, T. J. Fraser Tool Supply Co.

Wilfred S. Gandy, Peterborough, salesman for A. C. Wickman Ltd.

William Giessmann, Santa Clara Valley, owner of Able Tool Design Co.

Theodore F. Harris, Windsor, factory manager for Bendix Eclipse.

George P. Herman, Nebraska, partner with Oehrle and Bergman.

W. H. Jewell, Elmira, vice president of Ingersoll-Rand Co.

Joseph A. Jordan, Syracuse, vice president of Barnes & Jordan, Inc.

Leroy E. Knight, Northern New Jersey, supervisor of incentives for Chicago Pneumatic Tool Co.

Albert O. Ohline, St. Louis, tool engineer with Moog Industries, Inc.

Carl A. Otto, Milwaukee, vice president of Johnson Service Co.

Emil J. Panuska, Greater New York, toolroom supervisor for Ford Instrument Co.

Hans Petersen, Twin Cities, chief designer, Continental Machine.

Winston C. E. Prins, Potomac, general engineer for U.S. Navy Department.

John J. Rodman, Cleveland, service engineer with Detroit Tap & Tool Co.

Joseph W. Roboshil, Philadelphia, foreman for Tinius-Olsen Testing Machine Co.

John Skurat, Mid-Hudson, process engineer for International Business Corp.

Raymond W. Wands, Syracuse, vice president of Mack-Miller Candle Co.



NIAGARA DISTRICT—Dr. D. G. Huber, chairman of the mechanical engineering department of McMaster University, Hamilton, Ont., speaks at the chapter's annual education meeting. Also pictured is Chapter Education Chairman Nick Erdie.

Hamilton District

"Heat Treating" was the title of a talk by C. Beingessner of B. & W. Heat Treating Co. at the Nov. 14 meeting. Some of the points brought out by Beingessner were: (1) always identify your steels; (2) watch decarbonization; and (3) apply the right steel and design tools correctly for greatest satisfaction when hardening. Ninety members and guests were present.

Position Wanted

ENGINEERING MANAGER—Age 37, present position, chief engineer; previous positions, chief industrial engineering methods and process supervisor, product engineer, tool and machine design supervisor, toolroom foreman; 15 years' experience in machining operations; die casting, plastic injection molding; great ability to design automated transfer equipment, as well in stamping as in machining operations. Ability to create a good climate for developing new ideas, as well in manufacturing methods as in product engineering; great ability in supervising people and administrative duties. Will relocate. Write to: Box 135, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Positions Available

TOOL DESIGNER—Machinery manufacturer in North Carolina needs tool designers with cutting tool and fixture design experience. Excellent opportunity for growth. Send resume. Include telephone number. Write to: Box 136, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

TOOL DESIGNER—experienced in the design of jigs and fixtures in the sheet metal industry. Please write Mrs. Griffin, Barry Controls, Inc., 700 Pleasant St., Watertown 72, Mass. WA. 3-1150.

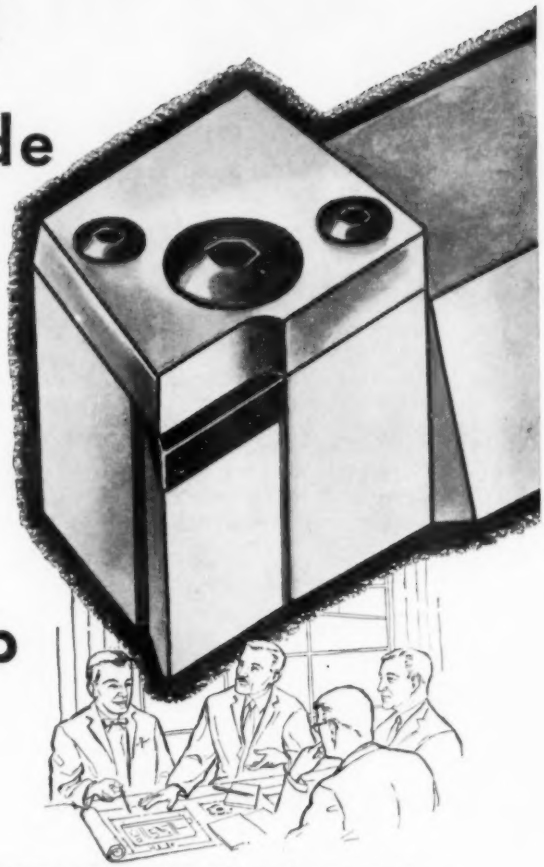
SPECIAL EVENTS

ASTE 27th Annual Meeting. April 18-22, 1959, Schroeder Hotel, Milwaukee, Wis.

CHAPTER MEETINGS

PLACE	Feb.	SPEAKER	SUBJECT
California State Poly. College. At the College. 7 pm	11	**Paul B. Slater,** Paul B. Slater Co.	Buy Two—They're Cheaper
Catskill Region. Kingston Hotel. 7:15 pm	11	**G. W. Barnes,** Norton Co.	High Velocity Machining with Ceramics
Central Pennsylvania. Harvey's Smorgasbord. 6:30 pm	4	**J. E. Hawkins,** Pines Engineering Co.	Bending of Tubes and Structural Shapes
Chicago. Nielsen's Restaurant 8 pm	12	Several market development specialists	Panel Discussion on Numerical Positioning
Cincinnati. Engineering Society Headquarters. 8 pm Dinner, 6:30	10	**Harold Wagner,** Standard Electrical Tool Co.	Potential Unlimited—Electrical Grinding Spindles Applied to New and Existing Machine Tools
Cleveland. Cleveland Engineering and Scientific Center. 6:30 pm	12	**Robert Voss,** Voss Plastics	Plastic Tooling
Dayton. Suttmiller's Restaurant. 6:30 pm	16	**Joseph A. Psenka,** National Broach & Machine Co.	Broaching Procedures
Detroit. E.S.D.	12 19		Elections Automation
Elmira. Clinton Hotel. 8 pm Dinner, 7 pm	2	**D. B. Martin,** Ampex Div., Chrysler	Powdered Metallurgy
Erie. General Electric Community Center. 7 pm	3	**Robert Ewald, D. C. Nichols,** Gardner Denver Co.	Automatic Drilling of Ford Transmissions and Plymouth Bodies
Greater New York. Midstan House	7		Dinner dance
Hamilton District. Fischer's Hotel. 6:30 pm	13	**W. Orlick,** Tumbling Sales & Service	Tumbling. Members night
Indianapolis. Antlers Hotel. 6:30 pm	12	**O. J. Seeds,** Cerro de Pasco Corp.	Cerrotechnics
Kansas City. U-Smile Motor Hotel. 8 pm	18	**C. A. Barrett,** Die-Draulic Grip, Inc.	Piercing and Forming with Hydraulic Pressures
Keystone.	16	Representative of Shell Process, Inc.	Shell Molding. Election of officers
Lansing. Famous Grill. 6:30 pm	9	Representative of Dow Corning Corp.	Movie, "The Silicon and You."
Little Rhody. Providence YMCA Bldg. 7 pm	5	**C. G. Schelly,** The DoAll Co.	The Story of the Cutting Edge. Combined meeting with American Society for the Advancement of Management
Madison. Towne Club. 6 pm	26	**Max W. Carbon,** Univ. of Wisconsin	Nuclear Energy. Education and scholarship night
Merrimack Valley. Spaulding Metal Works. 6:45 pm dinner	5	**Lawrence Spaulding,** Spaulding Metal Works	Modern Foundry Practices. Plant tour
Milwaukee. Serb Hall.	12	**N. D. Verson,** Verson Press Co.	Cold Extrusion Impact Machining
Mississippi. King Edwards Hotel. 6:30 pm	12	**O. J. Seeds,** Cerro de Pasco Corp.	Latest Developments in Industrial Applications of Bismuth Alloys
Montreal. Canadian Legion Hall. 7:45 pm	18	**T. C. Helbert,** The Cincinnati Milling Machine Co.	Production Tooling Problem in Milling
Muncie. Delaware Hotel. 7 pm	3	**John Bradner,** Lees Bradner Co.	The Search for Silence
Muskegon. Doo Drop Inn. 6:30 pm, dinner	11	Representative of The Beryllium Corp.	Better than Gold
New Haven. Colonial House, Hamden. 6:30 pm	12	**Ralph Lane,** Fellows Gear Shaper Co.	The Art of Generating Gears
Niagara District. Atlanta Club. 6.30 pm	5	Representative of The Cincinnati Milling Machine Co.	Electrical Discharge Machining
Northern Massachusetts. Union Twist Drill Recreational Hall. Dinner, 7; meeting 8 pm	17	**O. J. Seeds,** Cerro de Pasco Corp.	Cerrotechnics
Northwestern Pennsylvania. American Legion Home, St. Marys. 6:30 pm	5	**Harry Conn,** Scully-Jones & Co.	Economics of Tooling and Manufacture. Election of officers
Oregon State College. Country Kitchen. 6 pm	27	OSC students	Technical talks. Portland, Ore chapter to be dinner guests
Saginaw Valley. Zehnder's. 7 pm	12		Panel discussion—Die Design
San Francisco. Rickey's Red Chimney	18	**Edward J. Cray,** Greenfield Tap & Die	Facts on Taps and Tapping
Santa Ana Valley. Palms Restaurant, Anaheim. 7 pm	2	Representative of True Trace Co.	
Sydney.	11	**Albert Joris,** Jewels Joris	Industrial Diamonds. Election of officers
Twin States. Adnabrown Hotel.	11	**Harold P. Granger,** The Bellows Co.	Controlled-Air Power. Election of officers.
Worcester. The Hickory House. 7 pm	24	**A. D. Gunderson,** Gorton Machine Co.	The A.B.C.'s of Numerical Controls as Applied to Panagraphs and Duplicators

Production Men ENGINEER the Carbide in the Tools... for Best on-the-job Results





PRODUCTION MEN KNOW cutting problems better than anyone else. That's why all V-R Carbides are engineered by production men to handle thousands of production applications. This fund of cutting know-how goes to work for you whenever you use V-R Carbides and cutting tools.

HERE'S THE POINT. You wouldn't specify 1020 steel for a job requiring a nickel-chrome 3140. Similarly, the proper Carbide grade is determined by the specific cutting problem. Give us the full details on your applications — V-R engineers will work with you to fit the right Carbide to the job.

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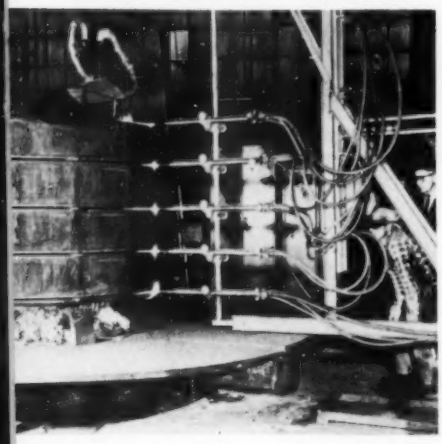
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Progress in Production

FASTER PRODUCTION WITH TURNTABLE SETUP

Production costs met a substantial cut through an ingenious twist in flame cutting procedures at Midvale Heppenstall Co. While in conventional operations cutting torches are moved over a stationary workpiece, in this setup work is positioned on a controlled speed turntable and rotated past stationary cutting torches. Example of the results: huge multiple ring forgings were flame cut into equal sized rings in less than one-tenth the time required for machining.

Five stationary torches make quick, accurate cuts in a multiple ring forging to produce four equal rings.



Engineering imagination created the unusual operation illustrated, set up with the help of engineers of Linde Co., Div. of Union Carbide Corp. Five torches mounted on a vertical rig slice the big forgings horizontally as they rotate past the torches. A single operator regulates speed of the electromotive turntable and controls intensity of the cutting flames. The drastic reduction in machining time is shown in the time statistics of one job which formerly took 320 hours but requires less than 115 hours using the new method—little more than one-third the original time.

Any type of steel from low carbon to high alloy can be cut with this setup which handles work from 36 in. OD to more than 200 in. Speed of the turntable, which can carry parts weighing up to 60 ton, can be controlled accurately from 0 to 20 turns per hour. Torch carriers move on tracks that are radial to the table.

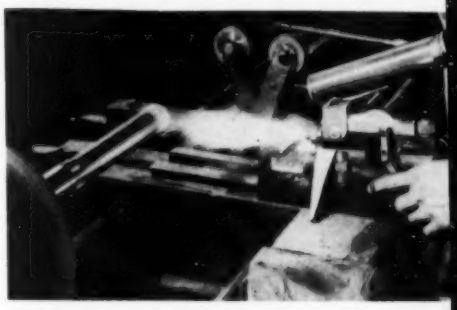
For bevels or vertical cuts, torches are mounted on a horizontal arm. With these, vertical cuts and deep 40-deg chamfer cuts can be made simultaneously on the inside of the rings. When completed, less than one inch is left on the cut faces for machining.

SPRAYED TUNGSTEN CARBIDE GIVES FACING EFFICIENCY

Hard facing with a spray gun means both efficiency and economy at Metallizing Engineering Co., Inc. The company recently developed a spray powder of tungsten carbide that permits deposit efficiency of better than 90 percent. Coating speeds are 110 to 150 sq ft per hour, 0.001 in. thick. Any coating thickness can be applied.

After spraying, coatings are torch fused. This, plus close control of coating thickness permitted and the comparatively smooth surface produced, minimize finishing operations.

Engineers of the company expect the process, which has been extensively field tested, to find wide application on parts subject to extreme wear conditions.

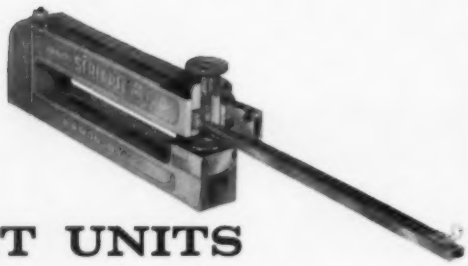


DEVELOP PRACTICAL TECHNIQUE TO DIE CAST BEADED CHAIN SPROCKET

An unusual method is permitting Gries Reproducer Corp. to die-cast sprocket shapes for use with beaded chain which hitherto has been economically impractical. The technique enables engineers to die-cast the sprocket in what is basically its original form. A No. 3 sprocket with 12 sockets and an OD of 7/16 in. currently is in production as the forerunner of a line of similar parts in the common sizes. Result is a sprocket that affords excellent traction and will operate satisfactorily at misalignments up to 23 deg in either the case of parallel or skewed shaft arrangement.

In order to produce the part economically, Gries uses high-speed automatic machines. Normally a one-piece die casting would be made in each shot on these units. To produce the beaded chain sprocket, two parts are cast and automatically trimmed and assembled in the same cycle on one machine. Such high-speed automatic production enables the company to sell the product at less than 2 cents apiece in quantity lots.

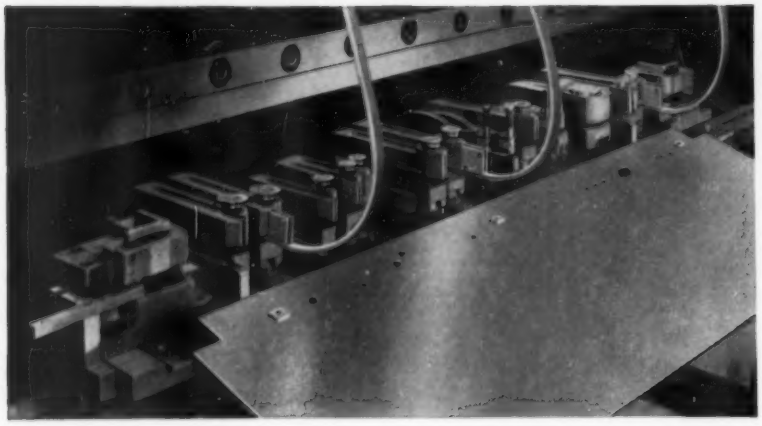
Originally, sprockets for beaded chain drives were made by machining. According to Gries engineers, early attempts to reduce cost of the intricate parts by die-casting were only partially successful because major revisions of the original design were necessary to make die casting economically possible. Consequently, former die-cast designs were considered to have suffered in performance. Gries met the problem by production technique.



NEW

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. . . stake nuts permanently with every press stroke !



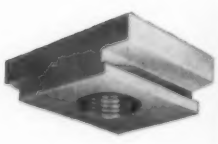
STRIPPIT PIERCE NUT UNITS save operations, time and money in assembly panel production with single-stroke insertion of Fabristeel Multipierce Nuts* into sheet metal up to .125″ thick.

Permanent Fastening by an Exclusive New Process—as nut pierces stock, metal flows into nut shoulder slot, becoming an integral part of the stock.

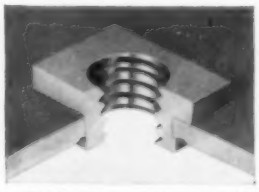
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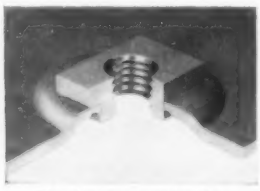
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ULTRASONIC SEAM WELDER JOINS DISSIMILAR METALS

Sheets of dissimilar metals can be joined continuously by an ultrasonic seam welder currently in the development stage at Westinghouse Electric Corp. There is no need for special surface preparation prior to welding with this equipment which promises to seam welding the advantages of ultrasonic welding. According to Dr. C. E. Arntzen, manager of Westinghouse's materials engineering department, "the apparatus will weld dissimilar metals not weldable by fusion processes." He points out that such metals can be joined by cold welding, but that method



Laboratory model of the ultrasonic seam welder is completing a weld between two 10 mil thick aluminum straps.

requires a large deformation of the metal pieces being joined, which ultrasonic welding does not require.

In operation, sheets of metal to be welded are passed between two wheels vibrating at 20 kilocycles per second. Periphery of the wheels presses against the metals on opposite sides of the sheets. At the point of contact, the wheels break up the oxide coating on the metal surfaces and by a kneading action weld the metal lattices on the surfaces of the metals themselves. Although appearance of the resultant weld is similar to an electric weld, no electric current passes through the spot being welded. As the weld is completed, the metals are moved through the unit by a variable speed drive.

Center of the vibrating wheel is attached to a transducer assembly which is used to convert electrical energy to the high-frequency mechanical vibrations. Electrical power causes the transducer to vibrate longitudinally. Vibration is passed down a coupling bar and enters the wheel, causing it to vibrate as

a solid disk with a free circumference. This action causes the center of the wheel to be pulled in and out and causes flexural vibrations to move radially out from the center of the wheel to its circumference. Wheel surfaces in contact with the work move in opposite directions by having the transducers work in opposition to each other. With the experimental welder, two sheets of aluminum 0.010 in. thick have been seam welded continuously at a rate of 15 ipm. Other accomplishments have been seam welding of light silver foil to ½ in. thick copper strap at 20 ipm. These welds were made while supplying 500 watts to each transducer or 1000 watts to the entire unit.

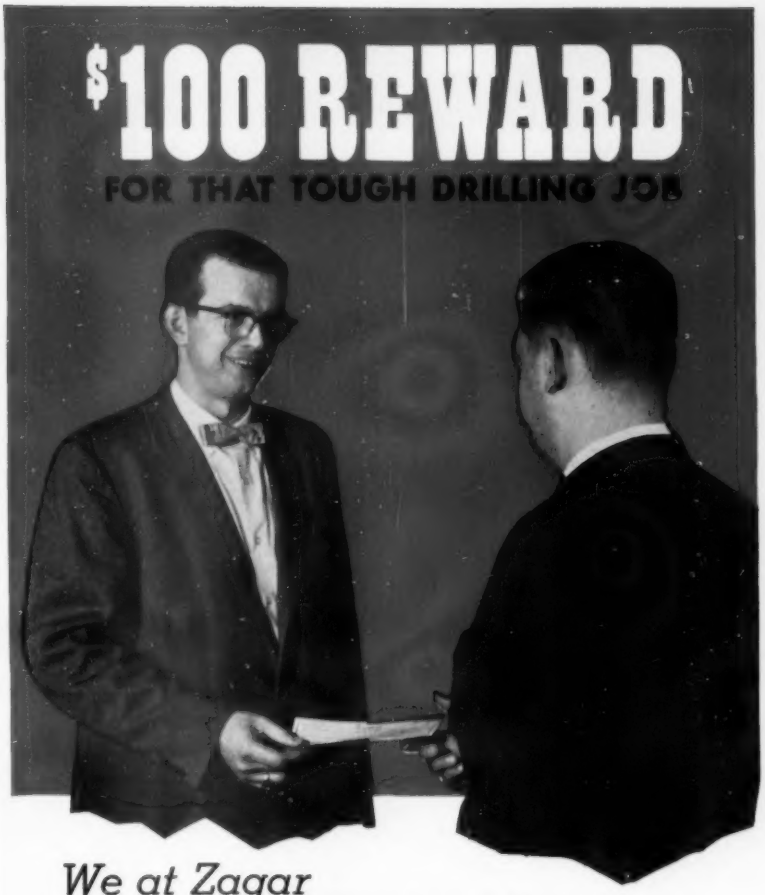
Investigation is scheduled to continue on the ultrasonic seam welder in an effort to increase welding speed as well as to increase the thickness of the metals that can be welded.

PRODUCTION MOLDING JOB UTILIZES PLASTIC

To achieve an economy line of pumps, Barnes Mfg. Co. has turned to a sturdy plastic that can be molded to precise contours of impellers on a production basis. For the conventional material for such parts in other lines, the company has used cast bronze. In the new setup, Kralastic, a resin-rubber blend produced by Naugatuck Chemical division of United States Rubber, is injection molded, to obtain a prime advantage—cost.



The company reports that there is virtually no variation in size or shape of the plastic parts which are formed as a single unit by the molding process. Exceptionally smooth surface of the plastic parts apparently aids water passage in the pump and contributes to efficiency. Temperature changes and rust also leave the parts unaffected.



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make the following offer:

We'll send you our check in the amount of $100 for every lead that materializes into an order for a drilling machine with these specifications:

1. Using 50 or more spindles at one pass.
2. Holes must be ½" diameter or larger.
3. Steel or other tough materials.

A hint to help locate such a job:

Plants and shops which use a large number of single-spindle drilling machines are logical prospects, because one Zagar multi-spindle drilling machine can drill up to 1500 holes at one pass.

Describe your job clearly for our Engineering Department to judge. *Please* include the coupon below.

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Please consider the accompanying job for a "$100 reward".

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STANDARD'S Carbide Tipped **EXPANDABLE SHELL REAMER**
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Electronic Tracer

Pencil line sketches of intricate shapes and forms can be used to guide oxygen single or multi-torch shape-cutting machines with this electronic tracer. A built-in automatic kerf compensator permits reproduction of one or thousands of complicated metal parts precisely from exact size drawings. Parts can be reproduced without necessity of making allowance for kerf width on the drawing.

The unit, known as the Linde Photocell tracer, requires no metal or plastic



templets, photographic negatives or silhouettes. Drawings of parts are made in the exact size of the part desired.

Tracing accuracy is assured and intricate metal shapes and small holes can be cut easily. The tracer is not sensitive to extraneous light and will not follow shadows. Tracing speed is controlled by an eddy-current governor which provides smooth, stepless speed control over a speed range adjustable from 2 to 30 ipm. At average cutting speeds, the tracer can negotiate 90 deg turns with 1/16-in. radius.

With the tracer it is possible to use line drawings that will make the cutting torches move from one series of cut shapes to another, without interruption. It is also possible to operate the unit manually by using a steering knob on top of the tracer.

Heart of the Photocel tracer is a photoelectric scanning head geared to a steering motor which in turn is connected by means of a geared belt to the drive head. The main control box can be remotely mounted. A small remote control box can be located either on the machine or on the tracing table.

Linde Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y. **T-2-1**

Weigher and Feeder System

A continuous weigher and gravimetric feeder system provides accurate automatic feeding. The weigher consists of a circular trough through which pass a series of flights attached to a rotating plate. These flights convey the material in a positive, continuous flow circularly through approximately 300 deg from entrance to exit points. The pivot axis of the weigher and the entrance and exit points are all in vertical alignment, permitting easy installation within existing processing operations. Control system for the weigher is adaptable to 3 to 15 psi pneumatic air signal control or mechanical systems.

Either a 24-hour dial or continuous type recorder is optionally available to give a record of the flow. They can be either electric or spring motor driven and located at a point remote from the weigher.

The weigher can be adapted with control equipment to operate as an



accurate gravimetric feeder. In most cases, the entrance and exit points of the weigher and feeder are in line with pivot axis of weigher. The device remains accurate under varying material characteristics and hot or cold material can be handled with equal accuracy.

Stephens-Adamson Mfg. Co., Aurora, Ill. **T-2-2**

Milling Machine

Rapid accurate milling of light and medium production work can be done on the No. 1 bed type milling machine.

Available in three standard arrangements to suit special needs, each of the models has lever feed for rise and fall of lever head; micrometer cross adjustment of saddle; 3-in. diameter adjustable overarm and heavy arbor support; counterbalanced milling head; 1-hp geared head motor and push-pull selector switch and starter. Six spindle speeds are in two ranges—111 to 1105 rpm or 247 to 2463 rpm. A 1½-hp motor instead of 1-hp is optional. Unusually wide tables facilitate mounting of large fixtures, and long ways provide spindle rigidity.

There are three standard arrangements: Model 1A for economy on small-lot production work. Table work surface is 9 13/16 x 27 in. with single T-slot, lever feed, 10-in. stroke and micrometer

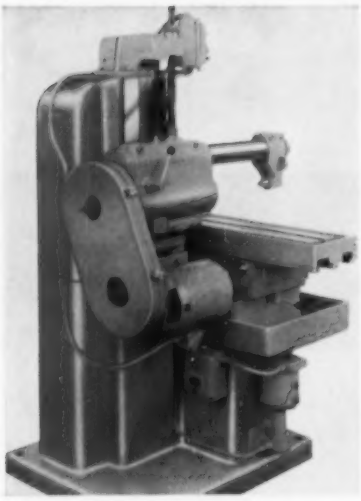


table stops. Model 1B with hydraulic feed is designed for longer production runs. It offers choice of two tables ($9^{13}/_{16}$ x 27 in. with single T-slot, 10-in. stroke, hydraulic lever control for rapid approach, feed and return; or $9^{13}/_{16}$ x 32 in. with three T-slots, 15-in. stroke, electrical push-button control for rapid approach, feed and return). It has hydraulic feed, including pump, cylinders and valving; infinitely adjustable feed $1\frac{1}{2}$ to 40 ipm; rapid traversing at 100 ipm, and adjustable table stops. Model 1C, for low production and toolroom work, has table work surface $9^{13}/_{16}$ x 32 in. with three T- slots, 15-in. stroke, handwheel screw feed with micrometer dial and micrometer table stops.

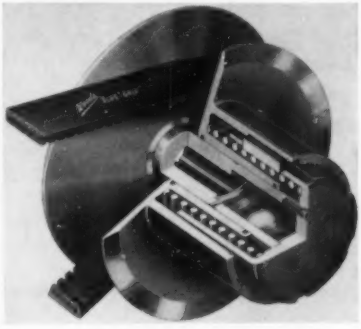
The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn. **T-2-3**

Adjustable Speed Sheave

The MS adjustable speed pulleys are designed to avoid fretting corrosion as well as freezing and sticking. Bearing surfaces are re-oiled from a reservoir with each rotation of the pulley.

There are no keys to obstruct oil flow around the surface between the flange hub and sleeve. A series of torsionally resilient nylon-faced rubber keys, located outside the bearing surfaces carry belt torque while assuring even distribution of the load and equal transmission of power by both flanges.

Pulleys will run indefinitely at set speed without sticking. There is no



down time, no periodic running through the speed range.

Turning the motor base handwheel to move the motor away from the driven machine, will slow the speed through a continuous range.

The series consists of five pulleys: MS-77-2, MS-97-3, MS-97-5, MS-127-10 and MS-127-15, rated respectively 2, 3, 5, 10 and 15 hp. The horsepower ratings are based at constant torque and for maximum speeds, that is at maximum pitch diameter. At other pitch diameters, horsepower capacities reduce in proportion to the driven speed.

T. B. Wood's Sons Co., Chambersburg, Pa. **T-2-4**

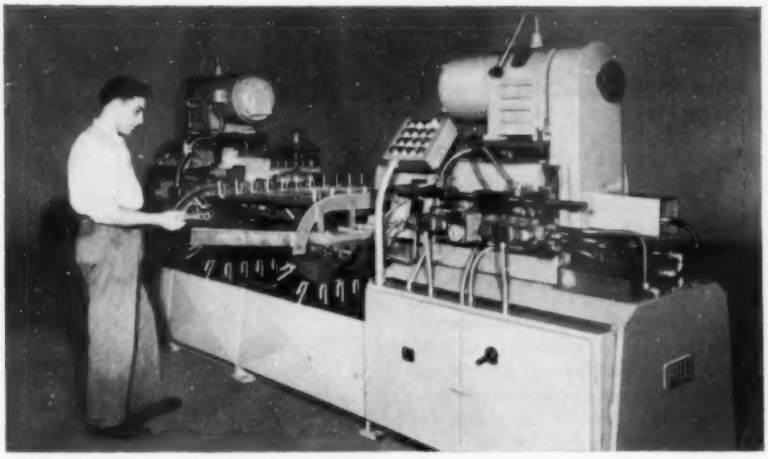
USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Double-End Transfer Machine

Up to six metal forming or metalworking operations are performed by this automatic, double-end transfer machine at high-production rates on each end of tubular or solid round stock.

It will handle stock up to 2 in. diam and will cycle at a maximum rate of 3600 pieces per hour. Stock is fed to the machine conveyor from a magazine or conveyor, carried through the machining or forming stations by the transfer





mechanism and deposited on another exit conveyor or tote box. Milling, centering, boring, threading, deburring, cut-off, spinning, flaring, press forming, and de-dimpling can be performed in combination on ferrous or nonferrous parts.

Two opposed motorized power heads, mounted on a fabricated steel base that encloses the hydraulic power unit and electrical control panel make up the hydraulically operated, electrically controlled machine. The heads can be positioned along the base on slides so that part lengths varying from 1 to 10 ft can be handled by one machine. Parts up to 50 ft long can be processed on a machine of this type.

The double-end transfer machines are made in a variety of sizes within the basic design to fit individual part production requirements. Head drive motors, spindle diameters and hydraulic power capacities are provided for specific operation sequence as are the overall lengths of the machine.

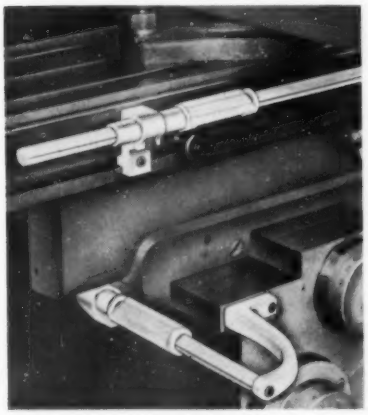
Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, Mich. **T-2-5**

Vernier Scales

Easily mounted on any machine, these vernier scales assure original accuracy. The expanded vernier can be read accurately at full arm's length without magnification.

Lead screw errors, backlash, and leadscrew wear cannot change the built-in accuracy. Because they are self-aligning, the scales are easily moved from one machine to another.

Edgcomb Engineering & Engraving Co., 1105 N. Hollywood Way, Burbank, Calif. **T-2-6**



Electronic Tracer Drives

Line of electronic tracer drives applicable to machine tools as feed drives on tracing operations are available with single-axis, dual-axis and full two-axis travel. Each drive unit consists of a tracing template follower; and operator's station; a packaged, cabinet mounted control unit; and controlled adjustable speed d-c feed motors.

The tracing head is rigidly mounted to the tool carriage so that it follows the contours of a tracing template. Control feed motors are mounted on the machine and coupled to tool feed screws. Motor control and regulating devices for the drive are housed in a single control cabinet which can be mounted on a common base with the machine, mounted on the machine itself, or near the machine. The operator's station can be located for operator convenience.

The drives are used where high volume, repetitive parts are produced; they cut down setup time from piece to piece. Depending upon the condition of the machine upon which the drive is mounted, repetitive accuracy of up to 0.0015 in. can be expected.

The drives are so arranged as to permit use of the machine tool man-

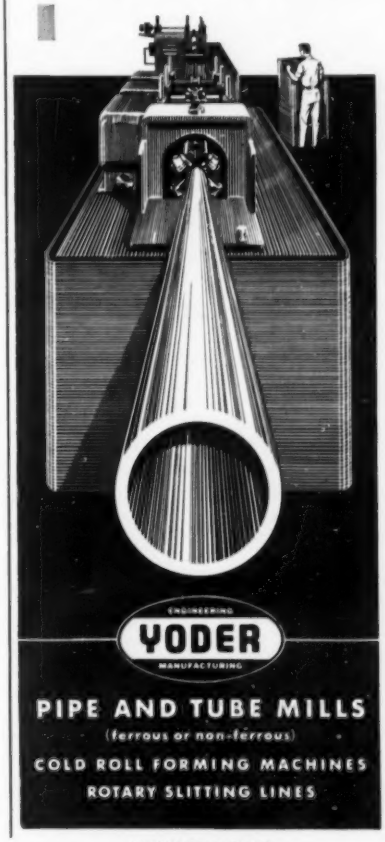
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INDICATE A-2-145

ually without using the tracer. Constant feed rate, regardless of the contour of the template, assures constant chip load and smooth surface finish. Speeds and feed rates can be changed by adjusting a single speed rheostat. The drive system also provides under-deflection control, so that if the stylus loses contact with the template, the feed motion is stopped to prevent damage.

The tracer drives also can automatically trace either the inside or the outside of a closed loop, with no attention from the operator. A ball and socket stylus design provides for accidental deflection of the stylus up to 90 deg without incurring damage.

Reliance Electric and Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio. **T-2-7**

Vertical Balancing Machines

Series of automatic Schenck vertical balancing machines for either static or dynamic balancing are made in five standard sizes and cover weight capacities from 0.5 to 1100 lb.

The balancers are particularly suited for disk-shaped parts. The workpiece holder (arbor or faceplate) is integral with the balancing spindle and can be provided with a quick clamping device. Once the rotor is set up and the starting button pushed, the machine runs automatically up to full speed; amount and location of the unbalance is shown by a light spot on the instrument screen and frozen in position, and the machine is electrically stopped. Complete cycle takes 10 to 20 sec.



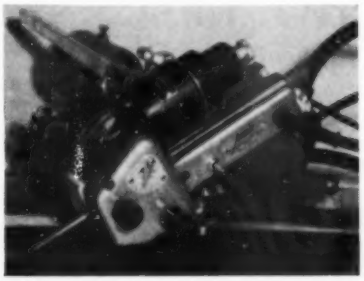
Standard, interchangeable component screens are available for workpieces that can be corrected only in certain circumference sections to eliminate split-up difficulties and correction inaccuracies. Correction units for drilling, milling, etc. also can be added to the machine for manual or automatic control.

Cosa Corp., 405 Lexington Ave., New York 17, N. Y. **T-2-8**

Automatic Torch for Welding Preparation

Model Q-3 automatic torch uses an electric arc to melt metal; simultaneously a jet of compressed air blows the molten metal away.

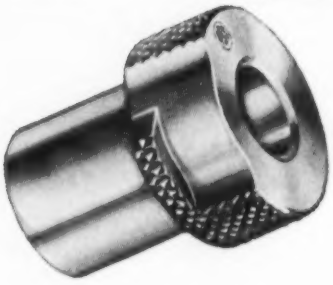
The device consists of a head with an electrode feed mechanism which feeds consumable copper coated carbon-graphite electrodes as required and supplies a jet of air at the proper location.



The head is mounted on a tractor permitting straight line or circular travel at predetermined speed. Where work is positioned, the Q-3 head can be removed from the tractor and mounted on the positioning equipment in the same manner as an automatic welding head.

The head can be set at any angle to

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the work to produce a variety of grooves and bevel contours. It will handle Copperclad Arcair electrodes from 3/16 to 3/8-in. diameter inclusive; the tractor has a speed range of 0 to 180 ipm.

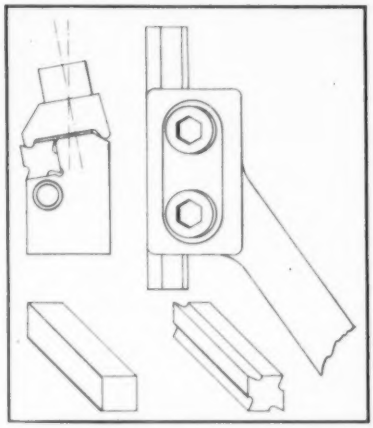
Arcair Co., Dept. 209, Lancaster, Ohio. **T-2-9**

Toolholder

A tool bit and chip breaker are combined in this single tool which preestablishes clearance and rake in the toolholder. Result is free cutting action and a short, cool chip.

The tool is designed to use high-speed steel, stellite and carbides. The bit is preformed with positive or negative rake —and the same bit can be used with right or left-hand holders.

Four cutting edges of the bit are used between grinds. Sharpening is accomplished by squaring the end of the bit.



An optional stop attachment permits use as turret tool block without changing setting or cross slide adjustment. Tool blocks also are available to adapt the tool to uses in screw machines, turret lathes, automatics or drill presses.

4 Sides Tools, 48 Highgate Rd., Berkeley, Calif. **T-2-10**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Water Soluble Cutting Fluid

The chemical solution, called Cimperial Concentrate, is a water miscible cutting fluid for heavy duty, low clearance, low speed operations. Mixed with water at dilutions ranging from 1:5 to 1:15, this single mix fluid can be used for standard milling and grinding.

This cutting fluid is said to increase tool life and cutting efficiency by means of chemical lubricity. Extreme pressure additives reduce heat of metal-cutting and permit fast feeds and speeds. Field tests show it produces a good finish and efficient metal-cutting action with less force on the tool than with conventional cutting oils.

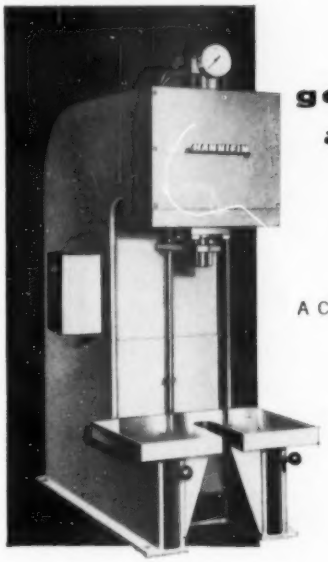
Effective bactericides in Cimperial provide lasting immunity from rancidity. It also has unusual rust control qualities even in lean dilutions. Two independent rust inhibitors prevent electrochemical process of rusting, and counteracts corrosion on all metals.

Cincinnati Milling Products Div., Cincinnati, Ohio. **T-2-11**

Hydraulic Marking Unit

A standard packaged unit for hydraulic roll marking is available as the No. 58U (illustrated), with or without hydraulic power unit. Also, as the No. 58 hydraulic marking machine, the same marking unit is mounted on a standard base.

The hydraulic marking machine, which measures only 1 ft square, can be mounted right side up, upside down or at any angle at any location. Because it employs the rollmarking principle, parts can be marked while in a



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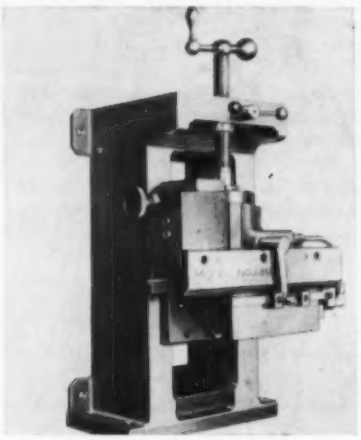
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fixtured position on rotary feed tables, in-line transfer units, or other automated setups.

Slide travel (left to right) is ¼ to 3½ in; up and down head travel is 0 to ½ in; maximum pressure is 8000 lb. The machine affords unlimited die space, while head adjustment is 4 in. Slide speed is fifty 1-in. strokes per min.

Cadillac Stamp Co., 17313 Ryan Rd., Detroit 12, Mich. **T-2-17**

End Mill

This center cutting end mill permits plunge cutting. At the same time cutting action of four flutes assures an excellent finish.

End mills in this line are made in double end as illustrated, single and



regular, single end long, and single end extra long. Sizes range from ⅛ to 1½-in. in various lengths.

The Weldon Tool Co., 3000 Woodhill Rd., Cleveland, Ohio. **T-2-18**

Universal Grinder

Bore, OD and rotary surface grinding is accomplished by a universal grinder capable of tolerances within 50-millionths roundness. The standard machine package is available as a basic machine with cross slide as standard, plus "building-block" attachments for special operations.

Hydrastatic antifriction ways are featured. Because of this, table and cross slide are supported on "pockets" of oil without metal-to-metal contact. Oil pressure of 75 psi in the pockets increases in whichever pockets are under load to maintain exact level of

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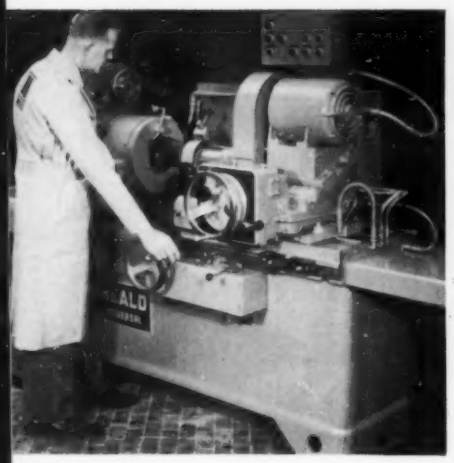


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the machine relative to the base. Horizontal and vertical control of ways is maintained within 0.00030-in. The 1800-lb table can be moved with ¼-lb pressure.

Standard machine has table travel of 20 in. Workhead cross slide travel is 11½ in, and workhead swivels 90 deg. Infinitely adjustable speeds of 150 to 450 rpm are afforded through 1½ hp variable speed workhead drive.

Workhead spindle flange with six holes and six slots has 9⅝ inch OD. Swing inside standard guard is 12 in. which allows taking a piece 8 in. long. Standard OD grind capacity is 12 in. Wheelhead cross slide travel of 1½ in. allows for compensation and feed.

Table speeds of 0-15 fpm for grinding and 35 fpm in rapid traverse are possible. Roughing cross feed is adjustable from 0.0001 to 0.0006-in on diameter, while finishing cross feed is 0.0001-in. on diameter.

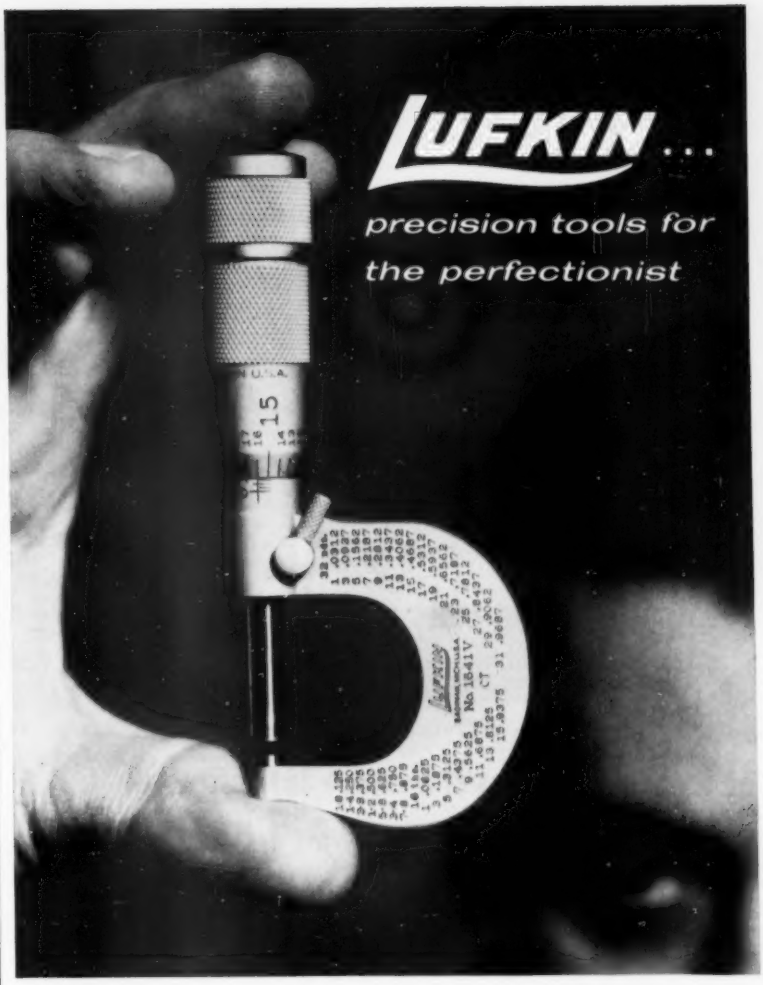
The Heald Machine Co., 5 New Bond St., Worcester 6, Mass. **T-2-19**

Profile Tracer Lathe

Bottle molds having noncircular cross section can be bored accurately and with relative speed with the rotary profile tracer lathe. In addition to accommodating most bottle mold work, the machine may be used for all conventional turning, boring and threading operations.

Major feature of the lathe is an ultrasensitive electrohydraulic tracer, the head of which is built into a bar that is adjustably mounted at the front of the cross slide. Stylus deflection pressure is 1½ oz. Electrical amplification of stylus movement instantly translates the slightest work contour change into hydraulic slide movement. Accuracy of reproduction minimizes later hand-finishing operations.

At a feed of 100 ipm, accuracy of



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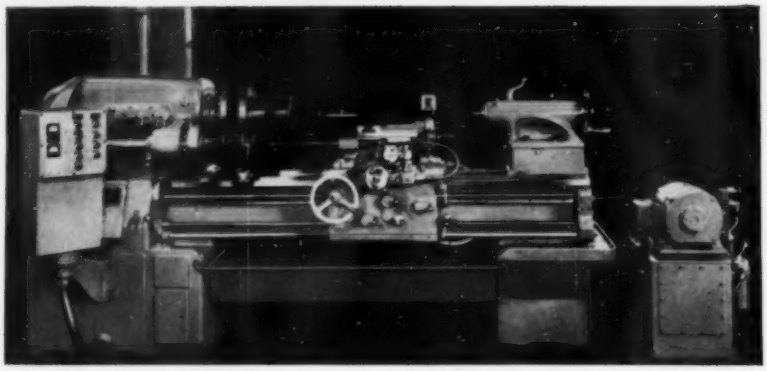
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duplication of the tracer slide is ±0.001 in. Maximum tracer slide stroke at one setting is 4 in. A slide mounted between the tracer slide and the swiveling tool slide provides tool adjustment for diameter. The tool slide is set parallel to the work axis for length adjustment of the tool; the cross slide is provided with automatic pressure lubrication.

The master spindle is located at the front of the machine for convenience in setup and operation. Positive gear drive from the headstock spindle through a quadrant mounted idler may



be adjusted to remove all backlash between the lathe spindle and the master. A timing device on the master spindle permits angularly positioning the master mold and workpiece.

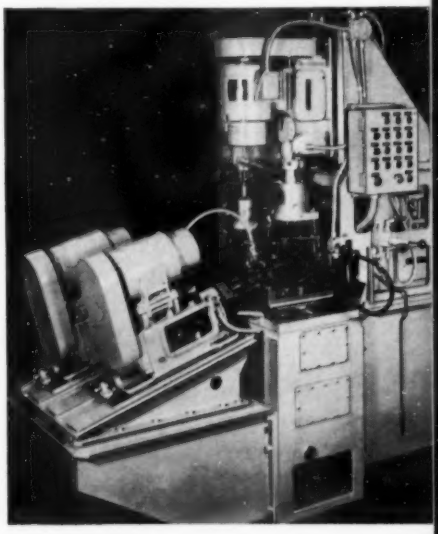
Either a female or male master can be used. With the master spindle locked stationary, a half mold or conventional flat template may be used to guide the tool for boring or turning. Because of the light stylus pressure, nonmetallic materials may be used as masters.

The Monarch Machine Tool Co., Sidney, Ohio. **T-2-20**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

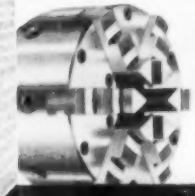
Gun Drilling Machines

Standard drill head and feed components are used on this machine for drilling gun parts. There are two basic machining stations. Six machining units, three heads to each station, consist of one horizontal, one vertical and one inclined up horizontal. At the first station, forepart of table, the gun



GOOD buying habit

Make sure every lathe in your shop delivers its full precision by using Buck Ajust-Tru Chucks



Sometimes it pays plenty to start new habits.
It does in specifying and ordering chucks.

Conventional scroll chucks *at best* guarantee only .003" accuracy *when new* – which falls off on wear.

Buck Ajust-Tru scroll chucks (2-3-and 6-jaw) guarantee *dead true* precision – guarantee *.0005"* chucking duplicate parts. The Buck adjusting principle greatly lengthens useful precision life. You get precision and many other features in Buck chucks *at conventional chuck prices.*

Start a good new habit today by sending for a catalog that shows why – "It pays to chuck with Buck."

Makers of Scroll, Power, Dust Proof, Independent Chucks.

BUCK TOOL COMPANY
233 SCHIPPERS LANE • KALAMAZOO, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-150

part is drilled simulttaneously from the inclined, vertical and rear horizontal units. The air-shuttle operated table moves to the second station adjacent. One hole is tapped from the 15 deg inclined unit, four tapped by the vertical head, and from the rear horizontal one hole is back counter-bored. Cycle of operation is automatic after loading the machine. Size of hole range is 0.116 to 0.404 in. Holes are as close as 0.250 in. center to center. The machining heads are fed by individual cam controlled drill units.

Zagar, Inc., 23892 Lakeland Blvd., Cleveland 23, Ohio. **T-2-21**

Grinding Quill

This external grinding spindle, called the 12x-350 quill, is available for use with the Dumore Series 12 precision grinder. It also is useful as a quill for special work heads mounted in the grinder or by itself held in a special fixture.

Completely sealed against grit and moisture, it is particularly suitable for grinding with diamond wheels on



ceramics, quartz, carbon, glass and other highly abrasive materials. Work can be performed with cutting fluids without affecting spindle operation.

Precision duplex bearings at the wheel end are capable of withstanding 572 lb thrust load and 1070 lb radial load at 8000 rpm for smooth operation and fine finishes.

The Dumore Co., 1300 Seventeenth St., Racine, Wis. **T-2-22**

Tap Follower

When this spring-loaded tap follower is tightened in the drill chuck, spring tension of 7½ lb is placed on the tap, leaving both hands free to easily and accurately turn the tap wrench handle. This assures precision in the first threads.

The tool, called Rigitap, is constructed of 4140 steel and fits all standard ½-in. drill chucks. Particularly useful in prototype and short-run pro-

Atrax PROGRESS REPORT

SOLID CARBIDE TOOLS

CASE HISTORY #19

MAJOR AUTOMOBILE MANUFACTURER

Atrax BORING TOOL Series 2010

OPERATION Boring 20 holes around 4½" O.D. x 3" I.D. Stator Blade Rings

MATERIAL Cast Iron

SPEED-FEED 8,000 r.p.m. at 10" per min. stock removal .014"

PRODUCTION 10,000 holes per grind. Use of this Atrax tool reduced number of special machines needed to maintain production from 18 to 6.

CASE HISTORY #30

MID-WEST PUMP MANUFACTURER

Atrax SOLID CARBIDE BUR Shape A-184

OPERATION Plunge cut to ¼" depth using milling machine

MATERIAL Beryllium Copper

SPEED-FEED Slow speed-hand fed

PRODUCTION Extremely fine surface finish resulted with virtually no wear on Atrax Solid Carbide Bur.

CASE HISTORY #31

EASTERN AIRCRAFT MANUFACTURER

Atrax END MILL Series 1505 (Slow Spiral)

OPERATION Reworking and salvaging hardened dies and fixtures for retooling program

MATERIAL Hardened steel Rockwell C-58 and case hardened materials

SPEED 1200 r.p.m. with hand feed

PRODUCTION Atrax Solid Carbide Slow Spiral End Mills used on this rework and salvaging application proved extremely successful in time and material savings.

Atrax

SEND TODAY for 96 page "STANDARD REFERENCE" on Carbide Tooling!

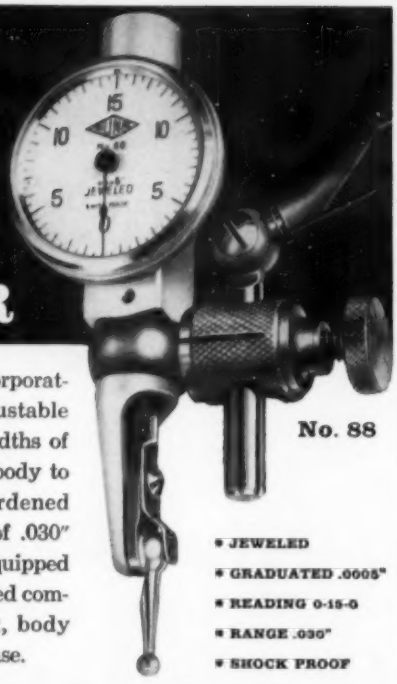


THE ATRAX COMPANY

Newington 11, Connecticut

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-151

ALINA DIAL TEST INDICATOR



A fully reversible indicator incorporating a clear easy-to-read, adjustable dial, graduated in half thousandths of an inch, a switch lever on the body to reverse action and TWO hardened chrome plated contact points of .030" and .100" diameter that are equipped with a non-slip ratchet. Furnished complete with a universal shank, body clamp, and plush lined steel case.

No. 88

- JEWELED
- GRADUATED .0005"
- READING 0-15-0
- RANGE .030"
- SHOCK PROOF

ALINA WRITE FOR LITERATURE AND COMPLETE CATALOG

ALINA CORPORATION

122 East Second St., Mineola, L.I., N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-152-1



In a word, plenty.

They can make your taps last up to six times longer.

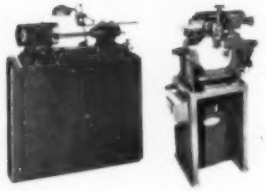
They reduce work spoilage because they enable taps to cut more accurately, more uniformly, with less strain.

They can cut your present tap costs up to 65%.

We didn't get these facts out of thin air. They come from actual case histories in metal-working plants where taps are sharpened regularly with Blake Flute and Chamfer Grinders.

These are high-precision machine tools. But they are not expensive. And they're simple enough to operate so that anyone in your plant can become accomplished at precision tap grinding with a minimum of fuss and feathers.

WANT PROOF? Just ask for it. You'll be glad you did.



Blake Chamfer Grinder/Blake Flute Grinder

Blake — and only Blake Flute and Chamfer Grinders, used in combination, create or restore: 1. exact indexing of cutting edges 2. controlled rake angles for each job 3. correctly ground spiral points 4. perfectly relieved chamfers . . . make one tap do work of six!

EDWARD **BLAKE** COMPANY, INC., 450 CHERRY STREET, WEST NEWTON 65, MASS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-152-2



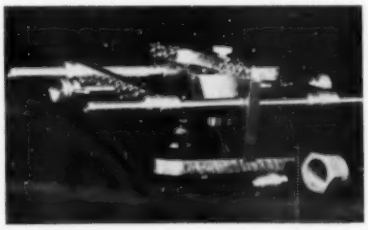
duction, it is suitable for drill press, lathe and vertical mill tapping applications. A Bantam model is available for 3/8-in. capacity chucks, and female centers are available for both models.

Rigitap Corp., 5941 Wilson Ave., Hollydale, Calif. **T-2-23**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Holding Device

This multipurpose jig, called the Hexijig, facilitates drilling holes through corners, flat or diameters of hexagon or round components. It will accommodate rounds from 1/4 to 1 1/2 in. in diameter and hexagons up to 1.574



in. Hole centers are adjustable to any variation and to any required accuracy.

Inverted Vee design of the fixture assures precise hole location and minimizes drill breakage. It can be set up in a matter of minutes and used successfully by unskilled labor.

For long runs and prototype work, the Hexijig is adjustable for wear, and replacement bushings are available.

Distributed by Wharton Unitools, Valley Stream, L. I., N. Y. **T-2-24**

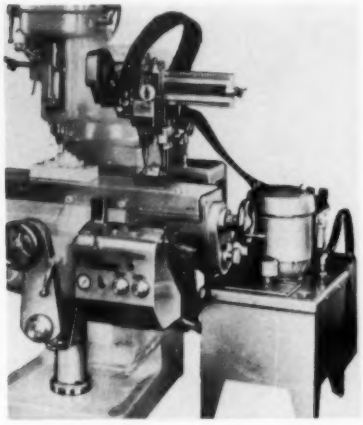
Tracing Attachment

Hydraulic, three-dimensional duplicating attachment, called Synchro-Trace, can be used to convert a standard machine into an automatic profiler for die sinking, mold making or general contouring work. Adapted to an engine or vertical turret lathe, the attachment reduces setup time and permits machining of contours that are inaccessible with conventional tracer controls without altering original capacity of the lathe.

For automatic milling, no operator is

required after setup. It provides infinitely adjustable feeds from 0.001 to 0.250 on either longitudinal or cross motions. Hand screw feed selection is available for all slides; power feed at infinitely adjustable rates is available on both longitudinal and cross feeds. Tracer stylus is fixed regardless of feed rate.

For automatic turning, the attachment traces both sides of 90 deg shoulders in



a single pass at a constant cut feed. A single dial controls both feed rates simultaneously.

Conventional lathe control can be changed to Synchro-Trace or vice-versa in less than a minute.

True-Trace Sales Corp., 9830 Rush St., P. O. Box 3307, El Monte, Calif.

T-2-25

Stock Feed Unit

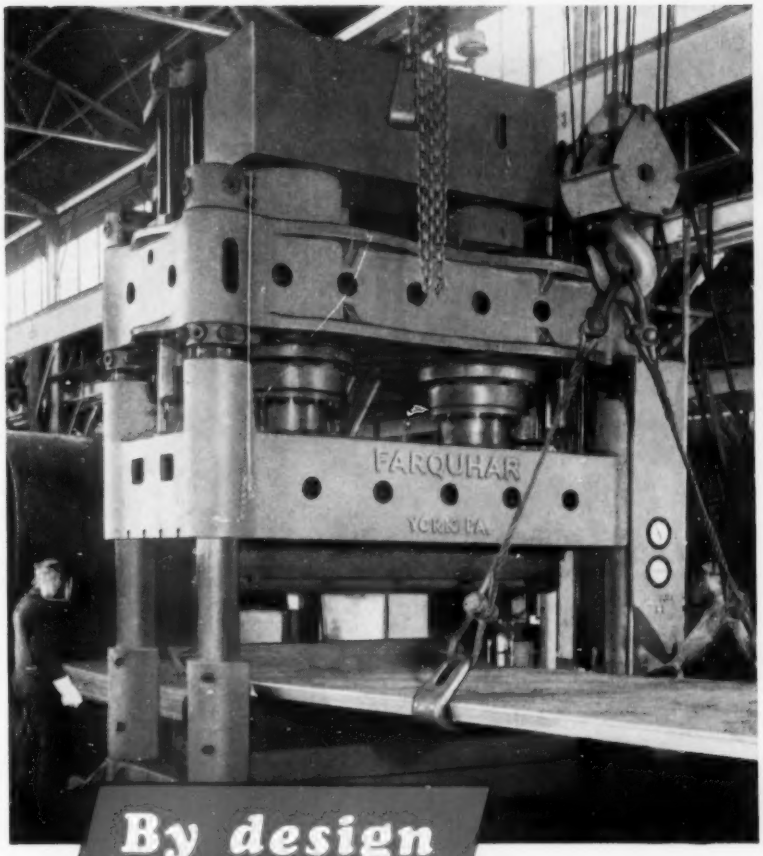
Almost any hand-fed punch press can be converted to automatic feeding with the Renco-Aire portable, air-operated stock feed. The unit, which incorporates the patented Micro Valve control can be mountetd in a matter of minutes with links or rods.

The punch press feed is entirely air operated. There are no solenoids, and thus no electrical connections are required. Air consumption is minimized because power can be easily regulated for individual job requirements.

The Renco-Aire is equally efficient for feeding strip or coil stock while maintaining uniform accuracy.

With the Micro Valve for accurate feeding stock grippers are opened for instant loading and aligning of stock through the guide. Stroke length is readily adjusted on the built-in feed control stop. Feed tolerances may be held as closely as ±0.002 in. With additional controls, the stock grippers can be set to synchronize with progressive die operations.

There is virtually no stock marking. Nylon, rubber or other nonmetallic



By design

this OLIVER-FARQUHAR Forming Press will cut your production rejects

By design this 1000-Ton Oliver-Farquhar Four-Column Hydraulic Forming Press has unusually rigid construction. This guarantees minimum deflection under full tonnage loads and close tolerance operation for accurate, high-output production. By design it can be equipped with either manual or electric pushbutton controls. You can select the controls to match your production requirements. By design special high and low pressure fluid circuits are incorporated in this press. Fast advance, controlled pressing and fast return of the rams assure maximum production.

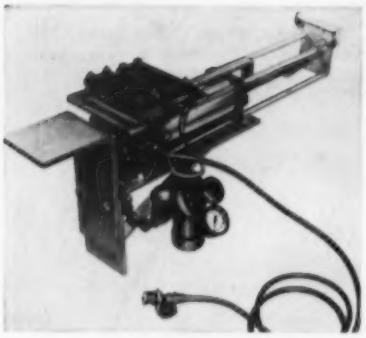
Oliver-Farquhar Hydraulic Presses are available in popular standard sizes from 50 to 5000-ton capacities. O-F Mechanical Gap Presses are available in 75 to 200-ton capacities. You are invited to write, wire or phone for details on these presses or, better still, ask for our proposals or recommendations. And remember, Oliver-Farquhar Conveyors can be designed and built to give you the ultimate in automated loading and unloading for maximum press production.

The Oliver Corporation
A. B. FARQUHAR DIVISION
Press and Special Machinery Departments
York 92, Pennsylvania

OLIVER Farquhar PRESSES

Also Manufacturers of Farquhar Conveyors

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-153



gripping jaws can replace the steel jaws for feeding highly polished or prefinished materials.

The Renco-Air automatic stock feed is available in four standard models, with 4 in. wide by 13 gage and 6 in. wide by 13 gage capacities. Stock lengths are adjustable from a minimum of ¼ in. to a maximum of 8 in. They can be easily shifted from one machine to another.

Industrial Sales Div., Cleveland Pneumatic Industries, Inc., 64 Old Orchard, Skokie, Ill. **T-2-26**

Pneumatic Grinder

A lightweight horizontal grinder and a high-speed die grinder have been added to this company's line of portable pneumatic grinders.

The horizontal grinder, designed for ease of handling and reduced operator fatigue in any metal removing or finishing operation, is available in various



sizes and models with speeds ranging from 3100 to 12,000 rpm. Wheel sizes range from 3 to 8 in. in diameter. Lever, straight or grip type handles may be specified.

The die grinder (illustrated) is available in two sizes, with rated speeds of either 40,000 or 60,000 rpm. They are suitable for a wide range of wheel sizes.

Three-bladed type air motors and high quality, air-cooled precision bearings are used. A silenced exhaust at the rear of the tools assures quiet operation. Both integral and remote type exhausts are available.

Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City, N. Y. **T-2-27**

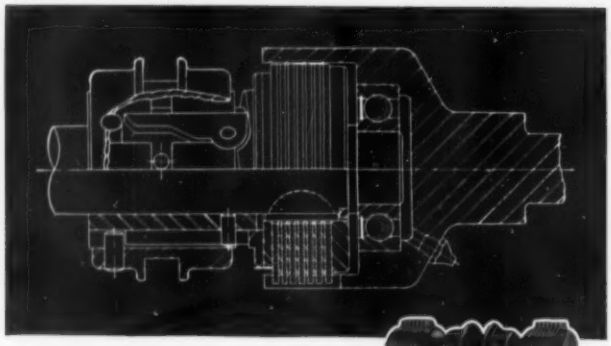
Automatic Positioning Table

A tape-controlled, 2-axis, point-to-point Micro-Positioner automatic positioning table can be used with any existing vertical spindle machine tool and requires no modification of the machine with which it is used. The self-contained unit consists of the table and control console which includes all programming and play-back controls. The table has 16 x 24 in. working surface and 14 x 18-in. travel.

The table traverses at a speed of 90 ipm with a 6-ipm approach speed. Position accuracy is ±0.001 in.

The positioning program is carried on two stainless steel tapes, one for each axis of the table. After the operator has directed the table to a hole location by reading coordinate dimensions from accumulating readers in each axis, a precise indentation is placed on each tape by a built-in pro-

ROCKFORD





Multiple-Disc • Single or Double • Oil or Dry Type

PULLMORE CLUTCHES

Provide

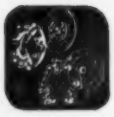
LONG WEAR LIFE

Heat-treated alloy steel provides wear-resisting bearing surfaces that are machined to close tolerances. The shifter spool has a deep slot, hardened and ground, which prolongs clutch life and reduces shifter fork wear. Discs have flat, true surfaces, free from high or low spots. Thus operating conditions remain uniform, even after long service.

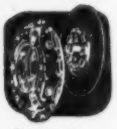
Send for This Handy Bulletin



Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.



Small Spring Loaded



Heavy Duty Spring Loaded



Oil or Dry Multiple Disc



Heavy Duty Over Center



Power Take-Offs



Speed Reducers

ROCKFORD Clutch Division BORG-WARNER

1329 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-154

grammer actuated by pushbutton. Each hole location is programmed in sequence in this manner. After programming, the table will automatically position to each hole location in sequence upon pushbutton command by operator. All functions are directed from the control console.

The compact size and relatively light weight of the Micro-Positioner allows



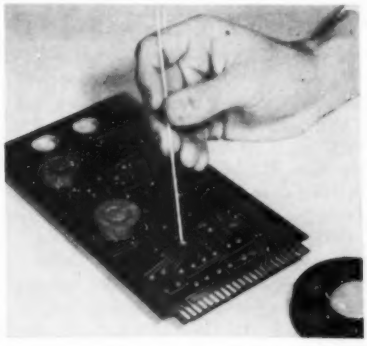
easy portability. Depending on production requirements, it can be moved to another machine tool for a different operation.

Industrial Controls Div., Topp Industries, Inc., 5221 W. 102nd St., Los Angeles 45, Calif. **T-2-28**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Conductive Cement

Hysol 6250 conductive cement, based on epoxy resins, contains only solids. Volume resistivity is measured at 0.01 ohm-cm at 25 C. Offering excellent



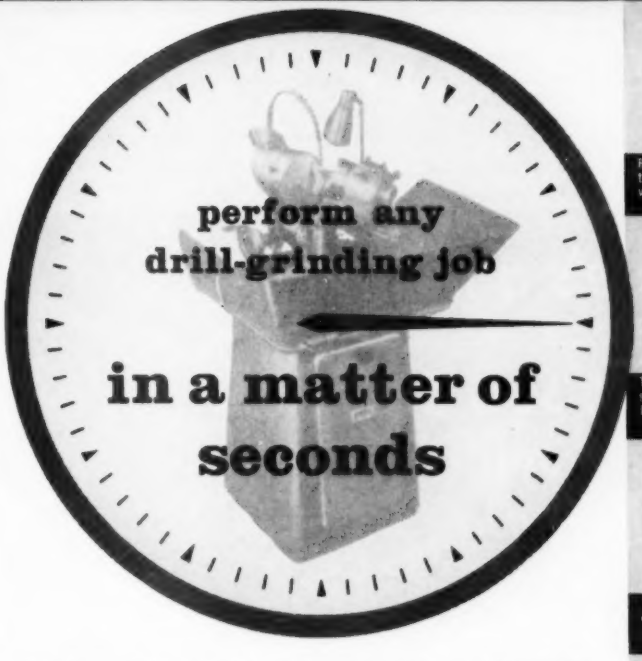
bond strengths to most materials, the cement is particularly useful for repair of printed circuits and for bonding of electrical components where soldering cannot be tolerated. The compound will cure fully in 24 hours at room temperature, or in two hours at 140 F.

Houghton Laboratories, Inc., Olean, N. Y. **T-2-29**

new, revolutionary

ALINA SELECT-O-POINT

drill grinders




Right hand twist drill, with centre


Twist drill for soft material, lips corrected


Three-flute drill (core drill)


Spot facing cutter, countersink angle 60°


Screw tap, grinding of the angle of rake

Designed for rapid and accurate grinding of:
Keyway Milling Cutters • End Mills
Spot Facing Cutters • Screw Taps
Twist Drills • Step Drills • Reamers, etc.

Three models to choose from — *No. 01-2 Range .004" thru .080"—No. 03-6 Range .012" thru .240"—No. 2-32 Range .093" thru 1.250".* Each machine is a complete system built around a *planned drill point.* Applied to twist drills, this new drill point will increase the useful life of your drills — reduce the drill thrust force — eliminate the need for center punching — produce a rounder and more accurate hole — and on the larger drills afford you a drill point that will produce a round and almost burr-free hole in sheet metal. Fully variable adjustments may be accomplished with a minimum of effort; settings once selected may be altered or repeated *exactly* at any time. Accuracy and simplicity is built into each machine.

WRITE FOR ILLUSTRATED LITERATURE

ALINA CORPORATION

122 East Second Street, Mineola, Long Island. New York

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-155

who's meeting and where

Feb. 2. UNIVERSITY OF KANSAS, Extension Center. Second midwest work course on Materials Handling Analysis, Kansas City, Kans. Edward S. Avison, University of Kansas Extension Center. 39th and Rainbow Blvd., Kansas City 12, Kans. can supply full data.

Feb. 2-6. AMERICAN MANAGEMENT ASSOCIATION. One-week program for manufacturing and other executives concerned with procurement and control of production materials. AMA Academy, Saranac Lake, N.Y. For details, write association, 1515 Broadway, Times Square, New York 36, N.Y.

Feb. 3-5. THE SOCIETY OF THE PLASTICS INDUSTRY, INC., Reinforced Plastics Div. 14th annual technical and management conference, Edgewater Beach Hotel, Chicago. Society office, 250 Park Ave., New York 17, N.Y. can supply more data.

Feb. 6-7. UNIVERSITY OF CALIFORNIA. 11th annual industrial engineering institute, to be conducted simultaneously on the Berkeley and Los Angeles campuses. Further information may be obtained from the Dept. of Conferences, University Extension, University of California, Berkeley 4 or Los Angeles 24, Calif.

Mar. 9-10. STEEL FOUNDERS' SOCIETY OF AMERICA. 57th annual meeting, Drake Hotel, Chicago, Ill. Get complete data from society headquarters, 606 Terminal Tower, Cleveland 13, Ohio.

Mar. 11-12. INSTRUMENT SOCIETY OF AMERICA, Pittsburgh Section. 9th annual iron and steel conference, Pittsburgh, Pa. More information may be obtained from society office, 313 Sixth Ave., Pittsburgh 22, Pa.

Mar. 11-13. PRESSED METAL INSTITUTE. 10th anniversary spring technical meeting, Pick-Congress Hotel, Chicago, Ill. Obtain more facts from institute headquarters, 3673 Lee Rd., Cleveland 20, Ohio.

Mar. 16-20. AMERICAN SOCIETY FOR METALS. 11th Western metal exposition and congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif. For details, write society office, 7301 Euclid Ave., Cleveland 3, Ohio.

Mar. 26. AMERICAN SOCIETY FOR QUALITY CONTROL, Rochester Section. 15th annual quality control clinic, sponsored by Rochester Society for Quality Control, University of Rochester, Rochester, N.Y. For details, contact Earl D. Hogan, Eastman Kodak Co., Kodak Park Works, Engineering Div., Bldg. 23, Rochester 4, N.Y.

Mar. 31-Apr. 2. AMERICAN POWER CONFERENCE, sponsored by Illinois Institute of Technology with cooperation of various colleges, and universities and professional societies. Hotel Sherman, Chicago, Ill. Direct inquiries to Conference Director, R. A. Budenholzer, Mechanical Engineer Dept., Illinois Institute of Technology, 3300 Federal St., Chicago 16, Ill.

Apr. 13-17. NATIONAL PACKAGING EXPOSITION, sponsored by American Management Association, International Amphitheatre, Chicago, Ill. Write association office, 1515 Broadway, Times Square, New York 36, N. Y. for more information.

Apr. 18-22. AMERICAN SOCIETY OF TOOL ENGINEERS. Annual meeting, Schroeder Hotel, Milwaukee, Wis. All details are available from Society office, 10700 Puritan Ave., Detroit 38, Mich.



This blade could have been packaged and shipped as a genuine MARVEL High-Speed-Edge Blade . . . and it might have performed to a customer's satisfaction. Instead, it was rejected and will be scrapped because inspection revealed a minute imperfection.

There's nothing unusual about this. Certainly, other hack saw blade manufacturers inspect their products, and undoubtedly reject blades for one reason or other, because they are trying to market the best blades they know how to make.

And that's the point—here at MARVEL, where the composite blade was invented and perfected over 30 years ago, we believe we know more about making high-speed-edge hack saw blades than any other maker. We've been at it longer, and the unequalled performance of MARVEL Blades on every kind of material is evidence that we're right.

Use MARVEL Blades on your power hack saws with perfect confidence that they have no equal. You can get MARVEL Blades at your nearby Industrial Distributor.

MARVEL Cutting Tools

Write for the new MARVEL Cutting Tool Bulletin.

PB-122

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE. · CHICAGO 39

Metal Cutting MARVEL SAWS
Better Machines · Better Blades

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-156

Field Notes

Work is under way for an initial $10.5-million construction phase of Ramo-Wooldridge Laboratories in Canoga Park, Calif. When completed, it will comprise the California research and development facility of the company's industrial and manufacturing interests. Six buildings scheduled for initial completion will include two research and development prototype buildings, an administration building, site utility center, cafeteria-auditorium, and a research and development prototype engineering facility and service building.

v v v

Construction has started on a $2-million research center by American Brake Shoe Co. The 30,000-sq ft building, which will be known as the Denison Hydrodynamics Research Center, will be operated by the company's Denison Engineering Div. Primary purpose of the facility will be to expand current research activities, and to launch advanced systems research in the fields of hydraulics, electronics and pneumatics to meet an anticipated future need by automated factories and complex weapons and air vehicle systems. According to expectation, the center will be in operation by next summer.

new divisions

A new gage division has been established by The L. S. Starrett Co. with manufacturing, engineering and sales facilities to design and build complete special gaging equipment. The division will offer counsel on special gaging problems and will manufacture gages to meet special requirements of a company.

v v v

Hydra-Blast Mfg. Div. has been formed by Automation Services, Inc. Main products of the division will be wel blasting, custom designed automatic and manual machines and process cycles as well as specially compounded wet-blasting abrasives and related supplies.

v v v

By setting up a Renewal Parts and Repair Div., Reliance Electric and Engineering Co. expects to improve customer plant operation. The division's goal will be careful analysis of drive failures. It is geared to handle repairs on all the company's a-c and d-c motors from 1 through 1,000 hp and all electric and electronic motor controls of the type made by Reliance. In addition, it will provide complete winding repair and parts for motors other than those made by Reliance.

v v v

Industrial control equipment made by Magnetic Amplifiers, Inc. will be handled by the company's newly formed Commercial Dept. Through an accelerated engineering effort, the company has developed four new equipments in the past 18 months.

v v v

The boards of directors of Thermoid Co. and H. K. Porter Co., Inc. have announced that Thermoid has become a division of Porter. The new division will manufacture and market all products formerly made by Thermoid Co. and Porter's Quaker Rubber Div. It will be headed by former Thermoid president Warren E. Hill as vice-president and general manager.

name changes

The company formerly identified as Johnston & Funk Titanium Corp. has changed its name to Johnston & Funk Metallurgical Corp. According to the announcement, name of the wholly-owned subsidiary of Mallory-Sharon Metals Corp. was changed to embrace the long line of types and shapes of wire, strip and foil the company now produces in a broad variety of metals and alloys.

v v v

Abrasives & Tools, Inc. is the new name for the company formerly known as Johnson-Devou, Inc. It was selected as being symbolic of the company's work and service in the field.

v v v

Name of Snyder Tool & Engineering Co. has been changed to Snyder Corp. Reason for the change was to avoid misconcepts about the type of equipment the company manufactures. The company was formed in 1925 to design and manufacture tools for the metal-working industry and when it became a corporation five years later, it began to build special machine tools. By 1934, it had stopped making tools entirely, and the next year began designing and building special machine tools which were its major products until it entered an extensive diversification program in 1949.

trade associations

National Machine Tool Builders' Association has announced plans to move its offices from Cleveland to Washington, D.C. The move, which is conditional upon subleasing the organization's present quarters, is expected to take place during the latter part of 1959.

v v v

American Machine Tool Distributors' Association has sponsored a contest among its members with an eye to advancing the art of preparing machine tool proposals and thus benefiting customers as well as members of the organization.

v v v

A technical society calculated to meet some of the requirements of the modern age, has been formed on the East Coast to complement a similar group now existing on the West Coast and in the Southwest. Name of the new group is the Society of Aircraft Materials and Process Engineers, Eastern Div. The society will be concerned with problems of aircraft and missile materials and processes. According to plan, quarterly meetings will be held for technical presentations and discussions related to the field.

new facilities

Jones & Laughlin stainless and strip division has completed additional servicing facilities at its plant in Detroit. The expansion, which includes a six-bay extension of the plant's stainless processing building and a five-ton overhead electric crane, will extend accommodations for stainless steel billet and bar inventories.

v v v

As part of its planned expansion policy, Foredom Electric Co., Inc. has transferred all operations to its new plant in Bethel, Conn. The enlarged plant facilities permit stepped-up production and delivery patterns while installation of special new machinery is expected to result in improvement of existing products and development of additional ones.

v v v

Hanson-Van Winkle-Munning Co. is operating a new facility for applying plastisol coatings to plating equipment it manufactures. Company officials say

discover now...
the most versatile
HARDNESS TESTER
ever made!



The
KING
PORTABLE
guarantees
accurate
on-the-spot
tests!



You save time and money on all Brinell tests with the King Portable. It provides hardness tests on all metals from softest lead to toughest alloys having over 700 BHN.

Uses loads from 62½ Kg. to 3000 Kg.

Keep it in the plant or take it out in the field — can be used in any position anywhere. It's rugged, lightweight and fast!

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Certain areas open for representatives

INDICATE A-2-158

that this results in reduced delivery time on coated equipment and reduced end costs. In addition to coating equipment that it now manufactures, the company also is taking orders for custom coating of plating equipment. The facilities enable the company to perform all related operations, including sandblasting, priming, preparatory baking, coating by both spray and dip processes, and final baking after application of the plastisol.

v v v

A new industrial optics plant has been established by Coast Instrument, Inc. at 5355 Long Beach Blvd. in Long Beach, Calif.

v v v

Dana Corp. recently moved employees of the production control, purchasing, plant engineering, quality control, time study, cost control, estimating, tool engineering and tool designing departments to new quarters in the recently completed $200,000 building. The new building is part of a $5-million plant modernization program which has been under way for the past two years at the Pottstown (Pa.) Division.

v v v

Construction of an aluminum dip brazing installation with a giant capacity has been completed by Meridian Metalcraft, Inc. in Whittier, Calif. The new facility is completely equipped for quantity production of aluminum assemblies. The main brazing tank measures 36 x 36 x 60 in. in depth. A 2,400-sq ft building was erected to house the new production equipment and the brazing tank.

acquisitions

Former Packard properties in Detroit have been purchased by Rolled Alloys, Inc. The new plant, with an area of more than 43,000 sq ft of floor space, will be completely modernized and equipped with the latest in materials handling methods, including new cutting facilities. Executive offices of the company will be headquartered in Detroit at 5309 Concord, adjoining the warehouse.

v v v

Negotiations have been completed for acquisition of two ball manufacturing companies by Hoover Ball and Bearing Co. Both Strom Steel Ball Co. of Erwin, Tenn., and Coolidge Corp. of Middletown, Ohio, were purchased for cash. The acquisitions were a step in Hoover's program of expansion in the ball and ball bearing industry, and will add approximately 15 percent to the company's total production capacity.

Sundstrand Machine Tool Co. has acquired the machinery division of Hanson-Whitney Co. The transaction covered manufacturing and sales rights to Hanson-Whitney thread milling machines but did not include any other products made by that company. Machines in the acquired line will be manufactured at Sundstrand's plant in Belvidere, Conn.

v v v

Purchase of the Buss Machine Works and its subsidiary, B & T Machinery Co., both in Holland, Mich. was announced by Greenlee Bros & Co. The transaction adds a new line of die casting machines to the Greenlee line of standard and special machine tools. According to the announcement, there will be no changes in the management and operation of the two subsidiaries.

v v v

Joseph T. Ryerson & Son, Inc. has now entered Texas with the acquisition of the Dallas and Houston plants and stocks of Vinson Steel and Aluminum Co. The transaction was accomplished by an exchange of stock.

v v v

Purchase of the Marion Electrical Instrument Co. of Manchester, N.H. has been completed by Minneapolis-Honeywell Regulator Co. through an exchange of stock. Roscoe A. Ammon, president of Marion Instrument, will continue as head of the operation, with no expected change in present administrative, sales and production organization.

v v v

National Standard Co. recently acquired operating assets of Cross Engineering Co. and will operate it as the Cross Perforated Metals plant. Present management of Cross will continue in the new organization according to announcement.

corporate change

The Ramo-Wooldridge Corp. has been merged into Thompson Products, Inc. Name of the new combined company is Thompson Ramo Wooldridge Inc. Identification of "Thompson Products" will be retained by Thompson's present automotive divisions. Ramo-Wooldridge has been an affiliate of Thompson Products since its inception five years ago.

new services

Industrial Inspection Supply Co. of Burlingame, Calif., and X-Ray Engineering Corp. of Gardena, Calif. now are operating mobile industrial X-Ray inspection units designed to cut scrap losses for plants not operating their

own X-ray departments. The portable units are truck mounted and powered by an electric plant.

v v v

A design engineering service, to be known as AA Industries, has been established by AA Gage Co. in Detroit. The new subsidiary, which will be staffed by engineers with practical shop experience, will offer three options to its services: design only, design and build, or build only.

anniversaries

Fifty years as specialists in industrial cleaning materials and methods are being celebrated by Oakite Products, Inc. Founded February 2, 1909 by David C. Ball, the company began as a one-man shop on Liberty St. in New York City. Led by Mr. Ball and his associates, Daniel C. Smith and George W. Oakley, the organization evolved new approaches and developments until today it requires 250 men working out of 17 divisional offices to serve some 36,000 industrial concerns. In addition it supports a research activity that now averages 12 new chemical specialty products a year.

v v v

Klaas Machine & Mfg. Co. is celebrating its 25th year in business. The firm, which started as a machine shop, has expanded into fields of welding and fabricating, designing and building special machinery for any use, as well as building its own product.

moves

Permag Corp. has moved its offices to larger quarters at 88-06 Van Wyck Expressway, Jamaica, N.Y. which will permit expansion of its facilities for grinding, cutting, magnetizing and demagnetizing magnetic materials.

Also moving to 88-06 Van Wyck Expressway in Jamaica is Allied Carbide Products, Inc., distributor and fabricator of carbide dies and products, diamond compounds etc.

v v v

Lundquist Tool and Mfg. Co., Inc. has relocated its plant at 677 Cambridge St., Worcester 10, Mass.

v v v

Raybestos-Manhattan, Inc. has moved its San Francisco district warehouse and offices to larger quarters at 168 Beacon St.

v v v

Abrasives & Tools, Inc. has moved into a new building at 131 Wayside Ave., West Springfield, Mass. in order to obtain larger quarters, better warehousing and shipping facilities.



NEW

This is the ~~old~~ grind at

ALLEN

A quarter of a million square feet of space in the great new Allen plant is devoted to precision fasteners – and much of it houses batteries of the latest, high-speed automatic centerless grinding equipment. Here you see a close-up of the grinding section set up to produce dowel pins at the rate of one a second per machine.

Allen's vast new facilities assure constant standards of uniformity, accuracy, strength and fit, many of which are duplicated nowhere else. Now there's more reason than ever to make Allen *your* Buy-Word for socket screws, keys, pipe plugs and dowel pins.

Speaking of dowel pins – specify *Allen* for great strength where you need it most. Made of Allenoy steel, they're surface hardened to 62-64 Rockwell C. Core hardness 47-53. Case depth .010" to .020". Shear strength from 160,000 to 180,000 psi. Precision-ground to ±.0001", with a mirror finish of 6 RMS max.

In stock at your Allen Distributor . . . in dias. from ⅛" thru 1" . . . lengths from ⅜" thru 6". Also in two standard oversizes – .0002" for press fit, .001" for repairs. For more details, ask your local Distributor, or write directly to the Allen Manufacturing Company, Hartford 1, Conn.



ALLEN HEAD
HEX-SOCKET SCREWS

technical shorts

Develop Finishes For Zinc Die Castings

RESEARCH in the field of corrosion performance of electroplated zinc die castings has brought about two new plating systems that promise to be particularly useful. Details on the research program which has been conducted at Battelle Memorial Institute under sponsorship of the American Zinc Institute, have been reported by William H. Safranek, a specialist in electroplating processes, speaking at a joint meeting of branches of the American Electroplaters Society and the Society of Die Cast Engineers.

First of the systems is a composite copper-nickel-chromium system. Chromium as thin as 0.000025 in. is deposited in a crack-free and pore-free coating. This plate then is applied over the customary thickness of copper and nickel. The composite plate has been found to provide excellent protection against corrosion. Accelerated corrosion and outdoor weathering data indicate a double or triple increase in corrosion protective value of composite copper-nickel-chromium electroplates as a result of slight increase in thickness of chromium combined with appropriate control of the plating conditions.

The second development is a duplex nickel system, in which two layers of nickel are electrodeposited in different baths. Conditions for plating the first thicker layer are adjusted to deposit nickel that is relatively passive to corrosive environments. The outer layer is plated under conditions for depositing bright nickel that requires no buffing. Although such nickel is chemically more active than dull or semibright nickel plate, investigations show that the duplex system furnishes considerably more corrosion protection than an equal thickness of a single bright nickel layer.

* * *

Process Derives Electrical Power From Chemistry

CONVENTIONAL propulsion systems could be radically changed through a new method for converting chemical energy directly into electrical power. This advanced development at Lockheed Missile System division laboratories has been described by L. Eugene Root, Lockheed vice-president and general manager of the missile division, as a "fuel cell" which has attained unprecedented efficiencies in electrochemical conversion. He announced that Dr. Morris Eisenberg, who is directing work on fuel cells, "has repeatedly achieved in laboratory experiments almost 100 percent of 'fuel' utilization and energy conversion efficiencies of 70 percent or better."

Dr. Eisenberg predicts that possible applications for the fuel cell include providing power sources for operation of both stationary and mobile industrial machinery. Basic differences between the fuel cell and the lead battery is that in the battery the active materials are inside the case. Electrochemical fuel is stored outside the fuel cell so the components of the cell are not consumed in the electrode reactions.

Energy produced by electrochemical reaction is measured in watt hours per pound of total weight. As compared to an automobile battery which yields between 8 to 10 watt-hours per pound, Dr. Eisenberg points to a fuel cell presently being developed which is designed to produce 100 watt-hours per pound. He predicts that one of 300 watt-hours can be developed within five years.

WHY Robbins IS YOUR BEST BUY



Only Robbins angular tooling equipment assures you positive accuracy when setting up to machine, grind or inspect angular work . . . because only Robbins gives you these exclusive features:

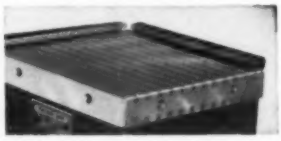
POSITIVE LOCKING locks firmly inside sine bar roll with expanding action for positive lock. Screw at each end locks toward front of unit, always pulls upper member firmly down on gage block without distortion. (Pat. app. for)





"PERMA-FLAT" SWIVEL BLOCK contacts gage block over entire face of swivel block instead of on a single thin line of contact. This patented feature provides greater contact between gage block and unit . . . combines with Robbins positive locking to assure the utmost accuracy.

FINE POLE ceramic magnet chuck, manufactured for Robbins by famed O.S. Walker Company, Inc. Strongest magnetic chuck available. Fine poles make it easier to set up smaller work, go right to the edge for easier setup next to rails.





IN ADDITION, both magnetic and non-magnetic models are built with ribbed base, intermediate and top plates for distortion-free strength and rigidity, with full-length ground roll seats for precision location, greater accuracy. All models make it possible to set up any angular work in just four simple steps . . . in minutes instead of hours! Before you purchase any sine plate, be sure you check Robbins' exclusive features. Write for new catalog!

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11961 DIXIE AVENUE DEPT. E DETROIT 39, MICH.

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Trade Literature

for free booklets and catalogs—use request card, page 167

Locking Pins

Illustrated with photos and drawings, 4-page folder stresses construction and advantages in detailed descriptions of quick-release BB-Pins for shear load and tensional load applications. Waldick Engineering Co., P.O. Box 398, Huntington Sta., L.I., N.Y. **L-2-1**

Bending Machines

Eight-page Bulletin No. 58 presents useful information on general bending theory and practice in addition to picturing and describing complete line of compression process production bending machines and accessories; includes discussion of economic factors involved in selecting equipment, and provides section modulus tables for pipes, tubes and rectangular bars for use in selecting correct machine size. Pedrick Tool & Machine Co., Inc., 3638-40 N. Lawrence St., Philadelphia 40, Pa. **L-2-2**

Material Handling

Revised, up-to-date, 16-page Booklet Number One, "The Basic Concepts of Industrial Material Handling", provides comprehensive introduction into basic principles of industrial material handling, telling what it is, what are its costs, what are its objectives and how to select proper equipment. Part of The Library of Know-How published by The Material Handling Institute, Inc., Educational Div., One Gateway Center, Pittsburgh 22, Pa. **L-2-3**

Surface Equipment

More than 300 standard items in precision surface equipment covered in 8-page Catalog No. 839; includes descriptions, illustrations and prices. The Challenge Machinery Co., Grand Haven, Mich. **L-2-4**

Boring Machine

Four-page bulletin describes and pictures heavy-duty, high production precision Olofsson Model 22 boring machine; gives details of design and operating features and includes specifications and specification diagrams. Olofsson Corp., Lyons Ave., Lansing, Mich. **L-2-5**

Rust Index

"Rust Index of the United States" lists different rates at which metal rusts for each of 523 U. S. cities throughout the country. Request only on company letterhead direct from Rust-Oleum Corp., 2799 Oakton St., Evanston, Ill.

Testing Machines

Twelve-page brochure, "Tinius Talks about Large Testing Machines," discusses in detail various features of company's universal testing machines of 1,000,000-lb capacity and over. The Tinius Olsen Testing Machine Co., 860 Easton Rd., Willow Grove, Pa. **L-2-6**



CIRCLE R saws and other metal cutting tools are precision made for regular production as well as for automation — perfected by our unique and exclusive heat treating process. Where required, we meet your demand for exacting performance by holding within very close tolerances.

MAGNAGLO inspection discards our rejects before they reach costly finishing stages — for you, practically eliminates the possibility of down time due to cutting tool defects and sets new standards of accident prevention to protect your workers.

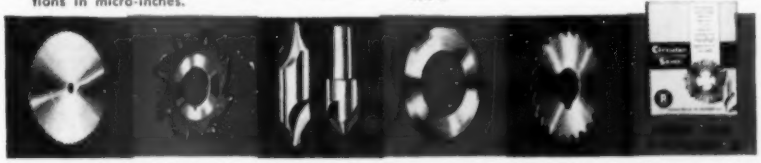
PROFILOMETER inspection, used wherever required, indicates surface finish variations in micro-inches.

PRECISION CONTROL of cost and quality is further assured by our use of other fine gauging equipment, under constant supervision.

Circle R Cutting tools better your production with longer runs, less down time, sustained tolerances, fewer stoppages for resharpening — yet cost no more. Consult our Factory Consultation Service at the plant — or call in your Circle R Specialist.

CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923

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METAL SLITTING SAWS • COPPER SLITTING SAWS • SCREW SLOTTING SAWS • COMMUTATOR SLOTTING SAWS • JEWELERS' SLOTTING SAWS • CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS • COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS

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this instrument will give you a decided edge in every competitive situation

NIKON OPTICAL COMPARATOR

for critical inspection and measurement of high-precision parts

A small investment, in one Nikon Optical Comparator, will spell enough economies to make a marked difference in your cost-competitive position. One, it will virtually eliminate the need for expensive mechanical gages. Two, it will release trained and skilled personnel for other critical work. And three, it will generally increase the efficiency, speed and accuracy of your quality control operation.

Inspection with the Nikon Optical Comparator is simply a matter of comparing the magnified image of the part under inspection with a master chart or a drawing affixed to the viewing screen. Precise measurements can be made of the most intricate contours—at a glance—by operators with comparatively little training. Further, accurate inspection of surface details and finishes can also be made. Thanks to Nikkor optics, the image is so bright and of such high resolution, that the entire inspection may be carried on in any normally well-lit room. And it can be viewed by several people at the same time.

So precise is the Nikon Comparator, that its use has enabled plants to enter into high-precision fabrication, and to achieve tolerances not available by any other methods. The Nikon Bench Model II can be easily carried from one part of the plant to another, for on the spot inspections and measurements, reducing "down time." Photo records of the image can be made in black and white or color.

It will pay you to investigate how a Nikon Optical Comparator can improve the cost-competitive picture of your organization. For complete details, write to: Nikon Incorporated, 111 Fifth Avenue, New York 3, N. Y. Dept. TE-2.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-162

Steel and Aluminum

Pocket-size, 256-page data book on aluminum and steel includes aluminum analyses, characteristics, mechanical properties and tolerance plus previously published information on steel such as machining and fabricating data, manufacturing practices and tolerances, weights, safe loads, ASTM standards, compositions and properties, etc. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill. **L-2-7**

Electrohydraulic Servo Valves

Four bulletins introduce new line of electrohydraulic servo system components. Bulletin 36100 illustrates and describes construction and operating principle of plungerless valve design, and includes specifications, flow curves and installation dimensions. Bulletin 36200 on "New Power Amplifier" covers specifications, capabilities and operation of Servocontrol's universal type amplifier. Bulletin 36300 on "New Preset Units" describes and shows construction and specification of these units. Bulletin 36400 on "New Panels" illustrates different forms and types of custom-built amplifier and control panels for operating electro-hydraulic servo systems. The Oilgear Co., 1571E W. Pierce St., Milwaukee 4, Wis. **L-2-8**

Boring and Reaming

Well illustrated 18-page brochure presents information on line of rough and finish boring and reaming tools; emphasizing important features and advantages such as floater cutting action, single-screw adjustment and interchangeability. Muskegon Tool Industries, Inc., 11th St. at Western, Muskegon, Mich. **L-2-9**

Nickel-Base Alloy

Twelve-page booklet presents physical, chemical and mechanical properties plus other important data on Hastelloy alloy F stressing advantages in resisting corrosion cracking as well as resistance to oxidization and other reducing conditions. Haynes Stellite Co., Div. of Union Carbide Corp., Kokomo, Ind. **L-2-10**

Oscillating Conveyors

Product information on trough widths, depths, section lengths, accessories and selection and application data for complete line of Flexmount, Coilmount and Torqmount oscillating conveyors presented in 24-page Book 2744; well illustrated with application photos, engineering drawings and operation charts. Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill. **L-2-11**

V-Belt Drives

Information on selection and installation of V-belts, detection of V-belt trouble, how to diagnose belt failures and correct drive troubles included in 12-page illustrated manual, "How to Get Longer Life from V-Belt Drives;" also gives maintenance tips and inventory survey check list. B. F. Goodrich Industrial Products Co., Akron, Ohio. **L-2-12**

Welding Electrodes

Twenty-page Bulletin 7000.2 serves as catalog and procedure guide for manual arc welding electrodes for hardsurfacing and for welding stainless steels, nonferrous metals and cast iron; describes each electrodes, properties and applications and how to use it; charts aid in electrode selection and identification and give welding machine settings for each electrode. The Lincoln Electric Co., Cleveland 17, Ohio. **L-2-13**

OBI Presses

Twenty-two models in line of newly designed open-back inclinable presses illustrated in 20-page brochure which describes entire line, outlines new specifications and stresses important features and advantages. Federal Press Co., Division St., Elkhart, Ind. **L-2-14**

Pressure Gages

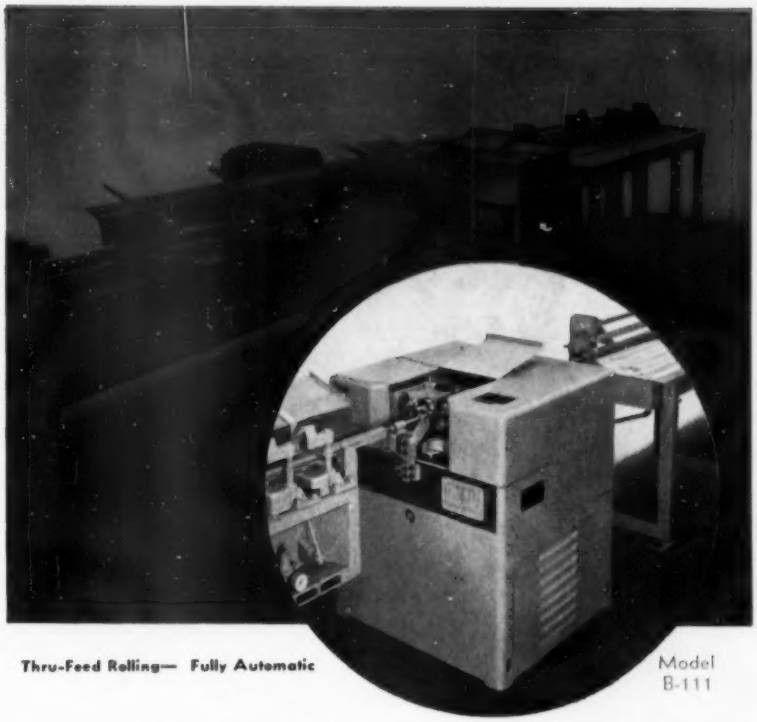
Complete line of Helicoid gages (including Safe-T-Case gages for severe or hazardous services) graphically described and illustrated in comprehensive 36-page Catalog DH-65; incorporates engineering information describing how the gages work, types of systems, adjustments, applications, dimensional drawings, specifications, accessories, and lists recommended uses. Helicoid Gage Div., American Chain & Cable Co., Inc., Bridgeport 2. Conn. **L-2-15**

Surface Grinding

Details of construction, design features and accessories for No. 510 surface grinding machine included in extensively illustrated Bulletin GM 54. Brown & Sharpe Mfg. Co., Machine Tool Div., Providence 1, R.I. **L-2-16**

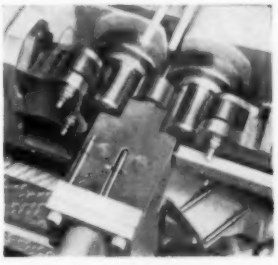
Tool Holders

Catalog No. 581 explains advantages of line of throw-away insert tool holders designed so they require no separate chipbreaker; includes section on throw-away inserts in carbide, cast alloy, oxide and high-speed steel; also includes a conveniently tabulated carbide grade comparison chart. Viking Tool Co., 1000 Nichols Rd., P.O. Box 471. Shelton, Conn. **L-2-17**

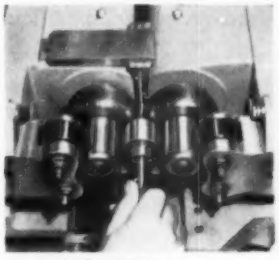


Thru-Feed Rolling— Fully Automatic Model B-111

.... for Production or Job lot Threading and Form Rolling



In-Feed Rolling— Fully or Semi-Automatic



In-Feed Rolling— Manual loading

REED Two-Die Type Cylindrical Die Thread Rolling Machines

The flexibility of the Reed B-111 machine provides for the most economical selection of equipment to suit job lot or quantity production requirements.

Standard machines are available for in-feed or thru-feed rolling or a combination of both for a wide range of thread and form rolling applications. Precise micrometer die and work positioning adjustments assure continuous production of uniform accurate threads and forms.

Write for Machine Bulletin B-111-1

REED TRM-173

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

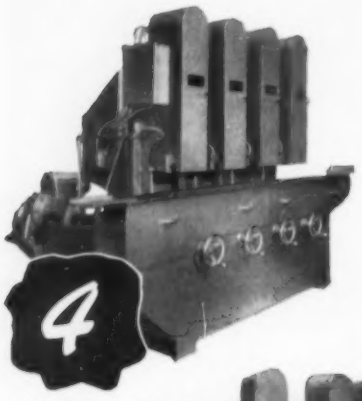
Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

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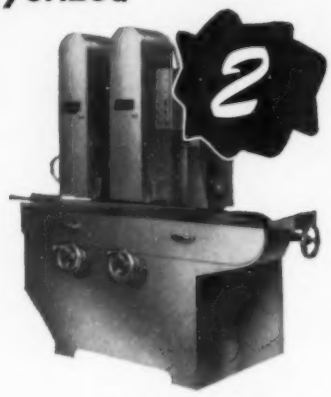
FAST . . . ECONOMICAL . . . VERSATILE . . .

ENGELBERG

Multiple-Head, Conveyorized
Abrasive Belt Grinders



FOUR-HEAD GRINDER
Finishes four operations in one-fourth the time.



TWO-HEAD GRINDER For two operations in one pass.



SIX-HEAD GRINDER Performs six operations in a single pass.

Pioneered and developed by Engelberg, the multiple-head, conveyor-type abrasive belt grinder is the modern production method of stock removal and finishing. Machines are available with from one to six or more heads.

From rough grind to final polish in a single through-feed pass the Engelberg groups finishing, sizing and polishing operations which might otherwise require several machines and operators.

Parts can be conveyorized or hopper-fed to machine's conveyor belt, and automatically ejected. Minimum set-up and change-over time add production dividends in both short and long run operations.

Whatever your grinding need, you'll find an Engelberg machine to fit it.

SEND FOR YOUR COPY of this Free Book: "How Abrasive Belt Grinding Increases Production at Lower Cost."



ENGELBERG, INC.

Precision ABRASIVE BELT GRINDERS

186 SENECA STREET • SYRACUSE, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-164

Presses and Preformers

Catalog describes complete line of hydraulic presses and preformers for the thermoplastic molding industry; discusses construction, operation, uses, and advantages of the equipment which can be controlled automatically or semiautomatically and provide various pressures for all types of molding material. Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, Ill. **L-2-18**

Anodes and Plating Chemicals

Illustrated by photos and drawings, 8-pages Bulletin AC-111 describes complete line of anodes and plating chemicals; includes composition, shapes and specific application data plus specifications for round, flat, elliptical and specially shaped anodes in various metals; discusses criteria for anodes. Hanson-Van Winkle-Munning Co., Matawan, N.J. **L-2-19**

Fluid Power Systems

Specifications, illustrations, and descriptions on complete line of standard Oilgear and Servocontrol Div. equipment presented in 12-page Bulletin 10051-G; covers industrial equipment; variable speed transmissions; presets, amplifiers, panels and servo valves for electrohydraulic systems; standard, combination and differential valves; and fluid power accessories. The Oilgear Co., 1571E W. Pierce St., Milwaukee 4, Wis. **L-2-20**

Switches

Sixteen-page Catalog No. 84 covers complete line of heavy duty limit switches giving details of three types — the plug-in 200 LS series featuring quick replaceability; the compact LS series; and sturdy ML switches in regular or explosion-proof types. This catalog with revised Catalog 83 cover complete line of industrial enclosed and heavy-duty limit switches. Micro Switch Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill. **L-2-21**

Milling and Boring

How to improve milling and boring operations at reduced costs discussed in Booklet F-68, "Winning Combinations That Reduce the Cost of Chips"; contains easily understood facts in discussions of such phases as: importance of matching cutters to exact capabilities of machines and to the work; sure way to get maximum performance from replacement blades; setup and cutter sharpening equipment; description of typical milling and boring cutters, tool designs and factors affecting selection. Cutter Div., The Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill. **L-2-22**

Retaining Ring Assembly Tools

Complete engineering dimensions and specifications for retaining ring pliers, applicators, dispensers and grooving tools presented in 16-page Catalog No. AT 10-58; includes selector guide, descriptions, size ranges and dimensions for all tools in line. Truarc Technical Service, Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N.Y. **L-2-23**

Metal Finishing Temperatures

Application of temperature controls in field of metal finishing—particularly the plating room—discussed in 4-page illustrated folder; describes in detail the recently introduced pneumatic controls as well as nonindicating, indicating and recording electrical controls and the line of thermally operated gas controls and thermometers. Advertising Dept., Partlow Corp., New Hartford, N.Y. **L-2-24**

Diamond Dressing Tools

Illustrated by line drawings, 10-page catalog describes line of diamond dressing tools to handle wheel dressing problems; outlines simple rules for advantageous use of the tools; includes ordering information and specification chart. Edco Tool Co., 93 Oak St., Wyandotte, Mich. **L-2-25**

Thread Comparators

Extensively illustrated brochure on "Gaging threads for high reliability" offers detailed information on advantageous uses of line of Tri-Roll thread comparators; includes specifications. Pratt & Whitney Co. Inc., Charter Oak Blvd., West Hartford 1, Conn. **L-2-26**

Centrifugal Casting

Well illustrated, 8-page brochure explains the centrifugal casting process, describes new casting applications and production steps involved; lists new metals and alloys and describes and illustrates various shapes and sizes that can be centrifugally cast. Centrifugal Casting Co., 3245 Cherry Ave., Long Beach, Calif. **L-2-27**

Presses

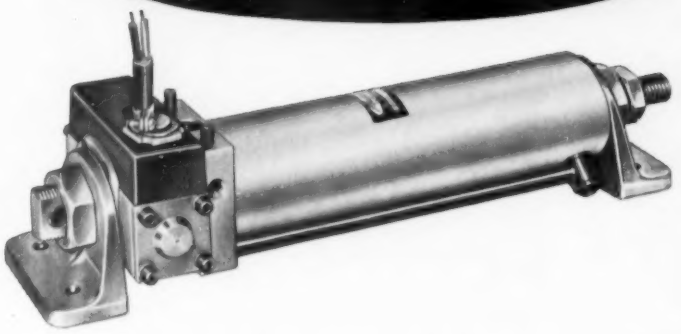
Comprehensive 44-page Bulletin No. 64 on redesigned and expanded line of straight side single and double crank presses contains complete, illustrated information on all operating and structural features; also includes useful charts and tabulated data on punch and press speeds, detailed specifications; special section deals with enclosed models. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y. **L-2-28**

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-2-146—Drill Bushings—*Accurate Bushing Co.* Complete line of drill jig bushings described in ABC Bushing catalog and price list. (Page 146)

A-2-174-2—Drills—*Ace Drill Corp.* Latest Ace drill catalog covers entire line of high speed steel and carbide drills, reamers, drill blanks and special drills. (Page 174)

A-2-231-4—Drill Bushings—*Acme Industrial Co.* Free drill bushing selector now available. (Page 231)

A-2-152-1—Dial Indicators—*Alina Corp.* Literature on complete catalog available on Alina dial test indicator No. 88. (Page 152)

A-2-155—Drill Grinder—*Alina Corp.* Illustrated literature describes the Alina Select-O-Point drill grinders. (Page 155)

A-2-13—Drill Bushing—*American Drill Bushing Co.* Catalog contains complete information on line of precision drill bushings for use on plastic tooling. (Page 13)

A-2-12—Tracer Lathes—*The American Tool Works Co.* Bulletin No. 135 gives complete description and examples on the American hydraulic duplicating lathe. (Page 12)

A-2-53 — Cutting Fluids — *Anderson Oil and Chemical Co., Inc.* 16 page illustrated catalog describes Lusol and other Anderson metal working products. (Page 53)

A-2-156 — Hack Saws — *Armstrong-Blum Mfg. Co.* New Marvel catalog gives complete story on Marvel metal cutting saws. (Page 156)

A-2-181—Tool Holders—*Armstrong Bros. Tool Co.* Literature available on complete line of Armstrong toolholders. (Page 181)

A-2-151—Carbide Tools—*Atrax Co.* 96 page standard reference on carbide tooling available. (Page 151)

A-2-190-1—Vibratory Feeders — *Automation Devices, Inc.* New literature available on the latest Peeco feeding techniques. (Page 190)

A-2-231-1—Drilling Unit—*Bedford Gear & Machine Products, Inc.* Catalog 10 decribes rotarized spindle drilling unit. (Page 231)

A-2-180-1 — Lathes — *Bentley Industrial Corp.* Literature and prices available on the Cardiff lathe. (Page 180)

A-2-228—Grinding Wheels—*The Blanchard Machine Co.* Free copy of "The Art of Blanchard Surface Grinding" (4th Edition) being offered. (Page 228)

A-2-172—Cutting Tools—*Brown & Sharpe Cutting Tool Div.* Catalog shows more than 3400 standard Brown & Sharpe milling cutters. (Page 172)

A-2-229-2 — Fixture Components — *Carr-Lane Mfg. Co.* Catalog No. 5 lists complete line of jig and fixture parts. (Page 229)

A-2-161 — Cutting Tools — *Circular Tool Co., Inc.* Catalog O describes complete line of metal cutting tools. (Page 161)

A-2-BC—Drive Unit—*Clearing Division of U. S. Industries, Inc.* Specifications and additional facts on Torc-Pac removable drive and slide unit now available. (Back Cover)

A-2-233—Lapping Machines—*Crane Packing Co.* Three free booklets contain data on production lapping and light band reading. (Page 233)

A-2-67—Punch Press—*Danly Machine Specialties, Inc.* OBI press catalog gives complete information on features and specifications of presses. (Page 67)

A-2-214-3—Die Cushions—*Dayton Rogers Mfg. Co.* Catalog F-44-A has data on die cushions for all punch presses. (Page 214)

A-2-42—Toggle Clamps—*Detroit Stamping Co.* Catalog shows clamp applications, scale drawings and complete information on De-Sta-Co products. (Page 42)

A-2-33—Tool Grinder—*DeVlieg Machine Co.* Catalog describes Micropoint tool grinder. (Pages 32-33)

A-2-214-2 — Drill Units — *The Electro-Mechano Co.* Literature and prices available on electric motor spindle air hydraulic feed E-M drill units. (Page 214)

A-2-164—Belt Grinding—*Engelberg, Inc.* Free book available on "How Abrasive Belt Grinding Increases Production at Lower Cost." (Page 164)

A-2-171-2—Lapping Machine — *Engis Equipment Co., Hyprez Division.* Technical bulletin LE-29 has complete information on Hyprez oscillating lapping machine. (Page 171)

A-2-197—Dial Indicators—*Federal Products Corp.* Catalog 58 describes complete line of Federal dial indicators. (Pages 196-197)

A-2-171-1—Microscope—*The Gaertner Scientific Corp.* Bulletin 147-56 has complete specifications on Gaertner's toolmaker microscope. (Page 171)

A-2-36—Milling Machine—*George Gorton Machine Co.* Complete line of equipment for the Gorton Mastermil described in bulletin 2699-2602. (Page 36)

A-2-IFC — Wheelhead — *The Heald Machine Co.* Bulletin 6-3 contains complete specifications on new Heald Red Head high speed belt-driven wheelhead. (Inside Front Cover)

A-2-180-2—Centers—*Ideal Industries, Inc.* Complete data and specifications in catalog on Ideal Gold Band live centers. (Page 180)

A-2-218—Milling Cutters—*Ingersoll Milling Machine Co., Cutter Division.* Booklet No. 68F has data on how to reduce cost of chips and improve milling and boring performance. (Page 218)

A-2-175—Progressive Dies—*B. Jahn Mfg. Co.* Brochure shows B. Jahn progressive die applications. (Page 175)

A-2-198-2—Tachometer — *Jones Motrola Corp.* Hand tachometer Jones #4800 described in catalog 147-D. (Page 198)

A-2-242—Induction Heating—*Lepel High Frequency Laboratories, Inc.* New catalog has 36 illustrated pages on high frequency induction units. (Page 242)

A-2-183—Milling Cutters—*Lovejoy Tool Co., Inc.* Catalog No. 31 describes complete line of face milling cutters. (Page 183)

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-2-206-2—Carbide Inserted Bushings—*W. F. Meyers Co., Inc.* New catalog No. 42 describes complete line of Meyco carbide inserted drill jig bushings. (Page 206)

A-2-165—Air Cylinders—*Modernair Corp.* Data bulletin has complete specifications on VIH cylinders. (Page 165)

A-2-43—Thread Rolling Heads—*National Acme Co.* Cost reducing ideas using Acme-Fette heads available in bulletin NAF-57A. (Page 43)

A-2-236-1—Hydraulic Clamp—*Newton Hydraulic Tooling Co.* Catalog contains full-scale templates on universal clamping system. (Page 236)

A-2-243—Lubricators—*C. A. Norgren Co.* Brochure No. 915B contains complete information on Norgren Micro-Fog lubrocontrol units. (Page 243)

A-2-173—Metal Cleaning—*Oakite Products, Inc.* Booklet describes "some good things to know about metal cleaning." (Page 173)

A-2-68—Induction Heating—*Ohio Crankshaft Co.* Free copy available of "typical results of Tocco induction hardening and heat treating." (Page 68)

A-2-229-1—Comparator Charts—*Opto-Metric Tools, Inc.* Catalog No. 56 has data on available stock comparator chart. (Page 229)

A-2-174-1—Hydraulic Cylinders—*Ortman-Miller Machine Co.* Bulletin No. 105 gives description and drawings of cylinder mountings and capacity charts. (Page 174)

A-2-199—Tooling Plate—*Pioneer Aluminum Inc.* Complete description of Pioneer 921-T-DC aluminum tooling plate available in new brochure. (Page 199)

A-2-148-2—Ultrasonic Cleaning—*Pioneer Central Div., Bendix Aviation Corp.* Free report on sonic energy cleaning now available. (Page 148)

A-2-206-3—Turrets—*Precision Processing Co.* Free literature available AK bed turrets. (Page 206)

A-2-163—Thread Rolling Machines—*Reed Rolled Thread Die Co.* Complete specifications on cylindrical die thread rolling machines in Machine Bulletin B-111-1. (Page 163)

A-2-30—Hydraulic Cylinders—*Rivett Inc.* Catalog No. 106 aids circuit design with complete drawing specifications on Rivett 100 hydraulic cylinders. (Page 30)

A-2-160—Angular Tooling Equipment—*Omer E. Robbins Co.* Complete line of magnetic sine "Magnasine", inspection sine plates and heavy-duty sine plates shown in the catalog. (Page 160)

A-2-154—Clutches—*Rockford Clutch Div. Borg-Warner Corp.* Bulletin shows typical installations and applications of Rockford clutches power take-offs. (Page 154)

A-2-210—Toolholder—*Coromant Div., Sandvik Steel, Inc.* Free booklet covers various T-Max styles and data on fast changing toolholder. (Page 210)

A-2-246 — Drilling Spindles — *Seibert & Sons, Inc.* Folio 1-50 illustrates and describes the complete line of Seibert multiple drill spindles. (Page 246)

A-2-47—Air Gaging—*Sheffield Corp.* Advantages of Sheffield air gaging systems is described in Catalog No. AGS-1-59. (Pages 46-47)

A-2-190-2—Bearings—*Southwest Products Co.* Revised manual describes complete line of Monoball self-aligning ball bearings. (Page 190)

A-2-56—Socket Screws—*Standard Pressed Steel Co.* Free booklet available on precision titanium fasteners. (Page 56)

A-2-15—Bore Gages—*The L. S. Starrett Co.* Bulletin No. 419 gives the advantages of Starrett #84 dial bore gage. (Page 15)

A-2-240-2 — Projector — *Stocker & Yale, Inc.* 8-page projection catalog has data on optical projection methods. (Page 240)

A-2-194-1—Cut-off Machine—*Stone Machinery Co., Inc.* Complete line of Stone metal cutting machinery described in free folder. (Page 194)

A-2-16—Die Set—*Superior Steel Products Corp.* 24 page catalog contains data on Superior die sets. (Page 16)

A-2-205—Surface Grinder—*Thompson Grinder Co.* Descriptive literature contains specifications of Thompson type D grinder. (Page 205)

A-2-51 — Band Saw — *The Henry G. Thompson & Son Co.* Circular describes the advantages of the new mill and band saw machine tool. (Pages 50-51)

A-2-10—Drill Heads—*United States Drill Head Co.* Catalog AD-57 has engineering specifications on adjustable U. S. drill heads. (Page 10)

A-2-215—Steel—*Universal Cyclops Steel Corp.* Descriptive brochure No. TS-101 contains data on LO-A low temperature air hardening tool and die steel. (Page 215)

A-2-138—Carbide Tools—*Vascoloy-Ramet Corp.* Catalog VR-58 gives complete details on carbide, ceramic and cast alloy cutting tools. (Page 138)

A-2-227—Retaining Rings—*Waldes Kohinoor, Inc.* 24-page catalog No. RR 10-58 has description and illustrations of the complete line of Truarc retaining rings. (Page 227)

A-2-140—Pierce Nuts—*Wales Strippit, Inc.* Complete specifications and catalog on Strippit pierce nut units. (Page 140)

A-2-198-3—Abrasives — *Brightboy Industrial Div., Weldon Roberts Rubber Co.* Catalog lists grains, textures, machine speeds for Brightboy rubber cushioned abrasives. (Page 198)

A-2-206-1—Adjustable Dies—*S. B. Whistler & Sons, Inc.* Catalog describes magnetic die, adjustable die and facilities for custom die work. (Page 206)

A-2-179—Spindles—*The Whitnon Mfg. Co.* Literature available on Whitnon high frequency electric spindles. (Page 179)

A-2-58—Hardness Testers—*Wilson Mechanical Instrument Division, American Chain & Cable Co.* Bulletin DH-325 and DH-326 describe Wilson hardness testers and Rockwell superficial hardness testers. (Page 58)

A-2-226-3—End Mills—*Woodson Tool Co.* Catalog has complete data on micro miniature end mills. (Page 226)

A-2-145—Tube Forming Machinery—*The Yoder Co.* 88 page illustrated book discusses the important aspects of "roll forming." (Page 145)

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Men at Work

At The Cleveland Cap Screw Co., THOMAS A. FRIBLEY was elected new executive vice-president. He is the son of Joseph W. Fribley, president and founder of the company. He also will continue as secretary of the company.

At the same time, ROBERT E. THOMAS, general sales manager, was named vice-president in charge of sales.

R. M. GORDON, formerly general sales manager of The Milford Rivet & Machine Co., was recently made vice-president for sales.

Titeflex, Inc. has named ANTHONY B. COBURN production control manager for the company. Prior to this appointment, he was production control manager of the industrial hardware plant at The Stanley Works.

LOUIS F. POLK has been elected president of the American Ordnance Assn. Mr. Polk, who belongs to ASTE's Dayton chapter, is vice-president and group executive of Bendix Aviation Corp. and president of The Sheffield Corp.

Michigan Tool Co. has made public appointment of IRVIN R. SPANGLER as sales manager for the machine and tools division. Formerly assistant sales manager, he succeeds PAUL F. ZERKLE, who will continue with the company as a member of the executive staff working on special assignments. Both men are members of ASTE's Detroit chapter.

Major realignments of responsibilities at Federal-Mogul-Bower Bearings, Inc. have affected three executives. R. S. STRICKLAND, who has been vice-president-sales and marketing, will head a new grouping of the company's bearing divisions with the title of vice-president-general manager, bearing divisions. R. E. KLARE, formerly general manager of the Federal-Mogul Div., became vice-president-operations, bearing division; while R. W. MUZZY, who previously was executive assistant to Mr. Klare, succeeded him as general manager of Federal-Mogul Div.

Vanadium-Alloys Steel Co. has named ARCHIE L. SPRATT as director of research and engineering for the Metal Forming Corp. Div. where he will be in charge of all technical problems relating to manufacturing procedures and products. He has been a metallurgical engineer in Vanadium-Alloys' custom service department.

Baker Perkins Inc. has announced election of R. C. RIEDER as vice-president of manufacturing. Prior to the election he was works manager of the company.

RODNEY T. DUNLAP was recently elected executive vice-president of The Torrington Co. Formerly vice-president and general manager of the company's Bantam Bearings Div., he succeeded Milton E. Berglund who was made president of Torrington.

Two executive assignments at Arwood Precision Casting Corp. involved HARRY MATTHIESON and JOSEPH J. SHIEL. Mr. Matthieson was named to the newly-created post of vice-president of process engineering. Mr. Shiel, formerly assistant plant manager at the company's Brooklyn plant, succeeded Mr. Matthieson as plant manager of that facility.

At Bohn Aluminum & Brass Corp., directors elected SIMON D. DEN UYL chairman of the board. Succeeding Mr. Den Uyl in the office of president is Terry W. Kuhn, formerly executive vice-president. RICHARD C. AYLWARD, general sales manager, was elected vice-president-sales, and H. BLAKE THOMAS, who has been general manager of the Betz Div., was elected vice-president. At the same time, vice-president-manufacturing Guy H. Pitts was made a director of the company.

The Grip Nut Co. recently made RICHARD R. SWANSON executive vice-president of the company. For more than ten years he has been a vice-president in the railroad and lock nut sales division.

Lipe-Rollway Corp. has revealed appointment of Robert M. Zimmerman to the post of vice-president of the corporation and of H. FOLLETT HODGKINS, JR. as vice-president of Rollway Bearing Co., Inc., a wholly owned subsidiary.

John D. Williams was elected president of Lipe-Rollway Corp. and Rollway Bearing Co., Inc. to succeed H. Follett Hodgkins, Sr. who became chairman of the Board.



Leonard Raymond, chief automotive engineer-research at Socony Mobil Oil Co., was elected president of the Society of Automotive Engineers, Inc. at its recent annual meeting.

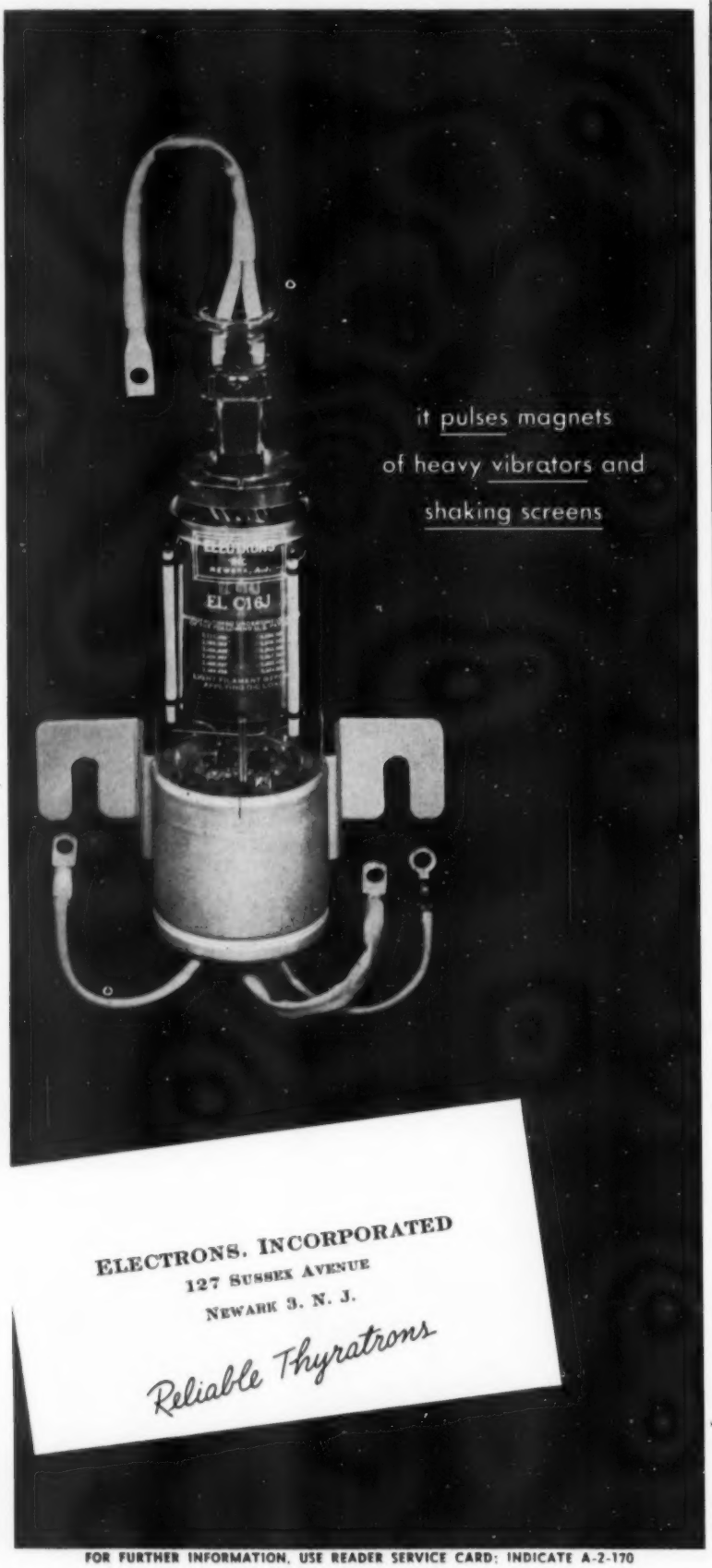


Donald A. Gaudion became president of Pfaudler Permutit Inc. following the election of former president Mercer Brugler as chairman of the board. He had been executive vice-president.



Milton E. Berglund is new president of The Torrington Co. succeeding Walter C. Thompson who was elected board chairman. Mr. Berglung previously was executive vice-president.





FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-2-170

Directors of Ultrasonic Manufacturers Assn. at the recent annual meeting, re-elected JACK T. WELCH to serve as president of the organization for a second term. Mr. Welch, who is a member of ASTE's Dayton chapter, is a division vice-president of The Sheffield Corp.

Changes in corporate management at Union Carbide Corp. made MORSE G. DIAL, president of the company, chairman of the board while he continues as chief executive officer. HOWARD S. BUNN, executive vice-president, became president.

Announcement of the appointment of LOUIS A. SACHA as director of engineering and production has been made by Milbar Corp. Prior to joining the firm he was vice-president and manager of sales for the East Shore Machine Products Co.

WILLIAM E. VOGEL was made plant manager of Atlas Drop Forge Co., wholly-owned subsidiary of Dana Corp. Mr. Vogel, who has served as assistant plant manager, replaces C. G. RYAN who was appointed vice-president-sales at Atlas. Mr. Vogel is a member of ASTE's Detroit chapter.

W. SCOTT BLISS has been elected vice-president-marketing of Vulcan-Kidd Steel Div. of H. K. Porter Co., Inc. Mr. Bliss was president of the former Kidd Drawn Steel Co. at the time of its acquisition in January 1958 by Porter and has been manager of Kidd products since the combination of Kidd and Vulcan Crucible in February 1958.

Appointment of ROBERT F. HODGSON as general sales manager of Hydreco Div. has been revealed by The New York Air Brake Co. He replaces E. J. HRDLICKA who resigned. Mr. Hodgson previously was manager of engineering.

PHILIAS H. GIROUARD has been named by Consolidated Electrodynamics Corp. to the post of development coordinator for the company. Succeeding Mr. Girouard in his former position as director of the DataTape Div. is HENRY S. BLACK who for the past five years has been manager of the corporation's southwestern regional sales office in Dallas.

At CEC's Electro Mechanical Instrument Div., JOHN P. MOFFAT, JR. was appointed to fill the newly created post of chief engineer. To fill his former position of director of quality control for the division, the company named W. J. BUSTEED who has been supervisor of tooling for the division's quality control department.



Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
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- Full 2" precision-lapped lead screws with correction device.
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Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
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Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

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INDICATE A-2-171-1

TOOL ENGINEERING in Europe

By M. Kronenberg
Consulting Engineer
Cincinnati 6, Ohio

Machining Titanium

Great difficulties are encountered in the machining of titanium due to its tendency to strain harden and its chemical sensitivity to hydrogen, carbon, nitrogen and oxygen at high temperatures. K. F. Meyer has published an article on this subject in *Industrie Anzeiger*, Vol. 80 (71), 1958, pages 1091-1094, under the title "Die Spanende Bearbeitung von Titan und seinen Legierungen."

He indicates that cutting temperatures are considerably higher than when machining steel and attributes the difference to the fact that titanium is a poor conductor of heat as expressed by its factor of thermal conductivity. The differences in cutting speed and in general machining conditions, which these qualities make necessary, are discussed and results obtained when using different types of sintered carbide tools are outlined. As an over-all average, titanium and its alloys permit only about one-third of the cutting speeds usually employed when machining steel of the same Brinell hardness, according to the author.

Ceramic Lathe Tools

The majority of ceramic tools consists of aluminum oxide. A company in Switzerland has had good results with a sintered material of 99.8 percent aluminum oxide according to a paper published by K. R. Pawlowitz in *Technik und Betrieb*, Vol. 10 (8), 1958, pages 121 ff., entitled "Keramik Drehwerkzeuge Heute."

The Swiss material has only one-third of the bending resilience of sintered carbide and also only one-third of the thermal conductivity. The author compares the tool angles used with those used for carbide tools. Ceramic tools



Step-up feeds, speeds, production... finish your cutting tools with

HYPREZ OSCILLATING LAPPING MACHINE

Records prove that the Hyprez Lapping technique increases tool output per grind 200% to 700% — improves speeds and feeds 50% to 400%. The lapping wheels rotate as they oscillate across the firmly held tool—producing a geometrically accurate and scratch-free finish.

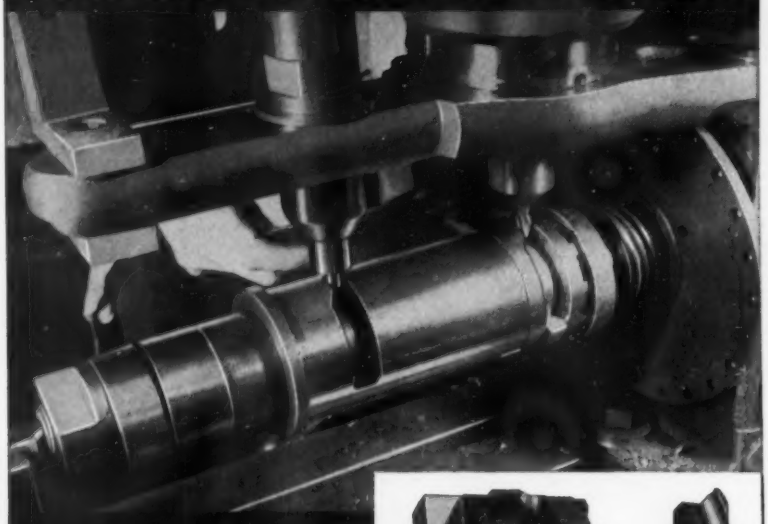
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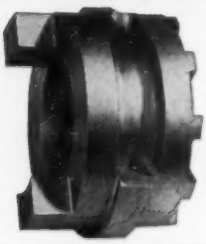
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ENGIS EQUIPMENT CO.
431 S. Dearborn St., Chicago 5, Illinois

INDICATE A-2-171-2

'Standard' off-the-shelf End Mill



Speeds Production, Speeds Delivery of Machine Tool Clutch!





Machine tool clutch showing cam track milled with "Standard" Brown & Sharpe End Mill.

½" "Standard" Brown & Sharpe High Speed double-end End Mill.

One of the 72, yes *seventy-two*, different Brown & Sharpe ½" End Mills that cut production days and add dollars of production profits to this job.

Operation: On tracer-controlled milling machine—plunge cut and peripheral mill a cam track contour in special, extra tough alloy steel machine tool clutch.

Choose the correct Brown & Sharpe End Mill from the World's Largest Stock of "Standards" and start production.

Eliminate days of waiting for special tools—eliminate trial and error of unproved tools—with Brown & Sharpe PRODUCTIONEERED CUTTERS!

Send for Catalog showing more than *3400* "Standard" Brown & Sharpe Milling Cutters to: *Cutting Tool Division, Brown & Sharpe Manufacturing Company, Providence 1, Rhode Island.*



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Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS
NELCO CARBIDE TOOLS
END MILLS

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INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

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are considerably easier to apply and performance is such that in a case where a machining operation with sintered carbide tools took 3.3 minutes, the same operation with ceramic tools took only 0.39 minute.

Machinability of Alloys

Metals used as high-temperature alloys are forms of Cr and Cr-Ni steels and heavy-metal alloys with a basis of Cr-Ni-Co-Fe, as discussed by H. Rohde in *Industrie Anzeiger*, Vol. 80 (71), 1958, pages 1079-1090. The title of his article is "Zerspanbarkeit Hochwarmfester und nichtrostender Werkstoffe beim Drehen, Bohren und Gewindeschneiden."

The author indicates that additions of Si, Mn, Mo, W, V, Nb, Ta, Ti, Cu, Al and N_2 are common practice, as well as the addition of boron and cerium. These materials, due to their hardness, toughness and strain-hardening characteristics, make machining difficult. Research related to machining conditions and tool design are described, showing how the difficulties have been overcome. The special tools for turning operations had to be designed so as to minimize the tendency to chatter when machining high-temperature alloys.

Ceramic Tool Studies

R. Weil has published an article on studies on ceramic tools in *Microtecnic*, Vol. 12 (2), 1958, pages 51-63, under the title "Contribution á l'étude des outils de ceramiques." After discussing the constitution and the physical propties of metal-cutting ceramic tools, the author compares the results obtained with French-made ceramic tools and those of European standards FI and HI carbide tools for machining of steel and cast iron respectively.

Cutting stresses and temperatures were investigated in order to establish the wear-resisting features of ceramic tools. It was found that the better performance of the ceramic tools is due to a better resistance to heat, absence of metal binders and chemical inertia. The resistance of ceramic tools to heavy cutting stresses and to impact was demonstrated by cutting tests which showed that such performance is possible if some care is taken in applying the tools.

Electrolytical Finishing

Electrolytical grinding and deburring processes are used at the Rheinmetal-Soemmerda Works. These processes are followed by galvanization on a mass-production basis. H. Kohlhase reports on the feasibility of this process in *Feingeraetetechnik*, Vol. 7 (9), 1958, pages 418-422, under the heading "Hin-

weise uever das Elektrolytische Polieren und Entgraten von Stahl."

Deburring is applied after machining, reducing the wear of the workpieces so treated. The article contains general information about the surface finish and the theory of the process, and includes a comparison of methods. The coefficient of friction is reduced and the life of workpieces increased by electrolytical polishing.

Care of Carbide Tools

Maintenance of sintered carbide tools and their correct use is discussed in an article published in *Industrieblatt*, Vol. 58 (8), 1958, page 351 ff, by R. Schmitz. The title is "Hartmetalle richtig Gepflegt."

Diamond wheels, mesh D70, in synthetic or metal bonds, are recommended and also silicon carbide wheels. For fine finish grinding, diamond wheels of a mesh size of D30, D15 and D7 should be applied successively and the grinding should be dry. A speed between 6½ and 26 fps is recommended in the case of boron carbide and between 16 and 32 fps if diamond is used.

The finish obtained varies between a surface roughness of 0.000040 inch and 0.000120 inch. Special attachments are used for the grinding of chip breakers. The author opines that the best such attachment consists of a diamond wheel elastically fixed to the grinding wheel axis.

Attempts to use diamond truing tools for truing silicon carbide or aluminum oxide grinding wheels have not been successful in a number of cases. Excessive heat is generated and the grains have the tendency to cut through producing a rough surface on the wheel. Silicon carbide or corundum grinding is always carried out wet. Diamond grinding is done dry, particularly in the case of fine grinding. The diamond wheel should be cleaned frequently with petroleum.

Chemical processes developed and owned by the German engineering firm of Josef Meissner in Cologne will be brought to the United States through an agreement with Girdler Construction Div. of Chemetron Corp. The German firm has its own research laboratories and pilot plant and specializes in design of continuous and automatic chemical processes. Under terms of the agreement, Girdler will handle all phases of design, engineering, construction, equipping and starting up of plants, as well as translating Meissner design data and flow diagrams into terms of American standards, codes and practices. Major applications for the processes include manufacture of plastics and other industrial products.

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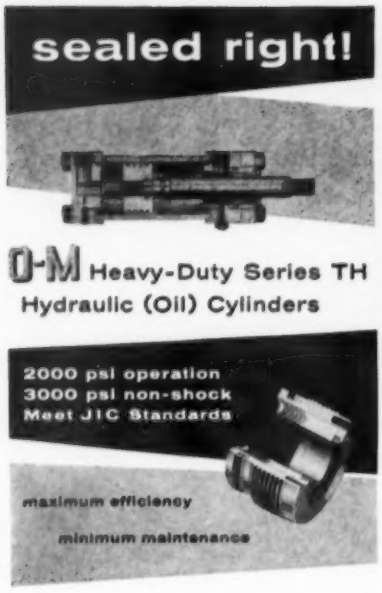
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good READING

DEVELOPING EXECUTIVE SKILL, NEW PATTERNS FOR MANAGEMENT GROWTH—*Edited by Harwood F. Merrill and Elizabeth Marting. Published by the American Management Association, Inc., 1515 Broadway, Times Sq., New York 36, N. Y. Price $9. 435 pages.*

Shortages of executive manpower is one of managements most serious problems. Many of the companies are solving this problem by use of systematic programs for management development to improve the executive skills and stimulate managerial growth. This book is a comprehensive presentation of various phases of this subject. The background requirements of the individuals as well as the specific tools and techniques of management development are included. Case studies based on actual company experiences are used to illustrate the technique application.

ENGINEERED WORK MEASUREMENT—*By Delmar W. Darger and Franklin H. Bayha. Published by The Industrial Press, 93 Worth St., New York 13, N. Y. Price $12.00. 630 pages.*

This book presents the various work measurement techniques including stopwatch and predetermined standards systems. A detailed presentation of the Methods-Time-Measurement (MTM) system is given which covers most phases of the method. At the end of each MTM section, study questions are used to help the student understand the fundamentals and uses of the data.

Other sections included in the book are methods for analyzing work standards, illustrating flow and process charts and using motion picture cameras for these work studies. Allowance, rating and work sampling are discussed as well as a review of the practical uses of work measurement such as labor control management.

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subject are included in the comprehensive bibliography. The book can be used for either the classroom or the plant as a textbook or reference.

INSTALLING ELECTRONIC DATA PROCESSING SYSTEMS—*By Richard G. Canning. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.00. 202 pages.*

The high cost aspects of installing electronic data processing systems and the questions of fitting them into the organization, selecting and training EDP personnel as well as programming are included in this book. Other phases cover the physical installation of the system, the preliminary operation and ways of effectively control costs based on actual case studies. Many experiences of companies of dissimilar fields have been synthesized into a single case history.

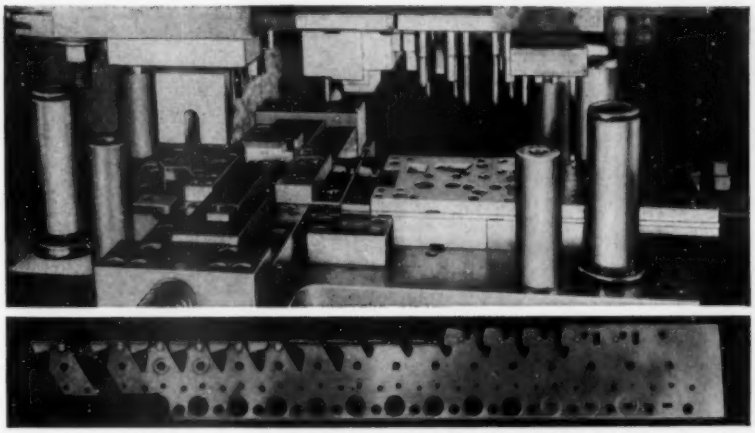
COATED ABRASIVES—MODERN TOOL OF INDUSTRY—*Sponsored by the Coated Abrasives Manufacturers Institute. Published by McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y. Price $8.50. 430 pages.*

A comprehensive and authoritative guide for the use of coated abrasives in industry including applications and actual case studies in many manufacturing fields. Coverage includes many recent advances in automatic machinery, an analysis of abrasives machinery by class and special topics such as cutting oils, coolants and lubricants specifically designed for use with coated abrasives. It is written to help the manufacturer decide which operations can be done better with coated abrasives and shows specific methods on how to obtain economical results.

SAFETY IN WELDING AND CUTTING, *American Standards Association AZ49.1-1958.—Published by American Welding Society, 33 W. 39th St., New York 18, N. Y. Price $2.00. 49 pages.*

Protection of personnel is extensively covered and includes the precautions necessary when using the newer welding processes. Eye protection is particularly stressed and recommendations are made for adequate shielding from flying particles and harmful rays. The precautions necessary when welding with inert gases are fully detailed and suggestions are made for the protection of fellow workers.

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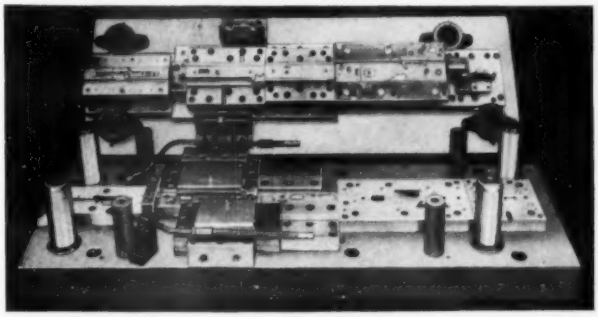
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Tech Digests

Effects of Recent INDUSTRIAL-DIAMOND Developments

By C. L. Fanning

Asst. Chairman
Machine and Wood Shops Dept.
General Motors Institute
Flint, Mich.

RECENT DEVELOPMENTS in the industrial diamond business will have profound beneficial effects in this country. As a result, our supply of diamonds will be substantially augmented, our diamonds will be more effectively used, inventories will be reduced substantially, and new jobs for diamonds will be created.

Scientific attempts to produce diamonds have been made ever since it became known in 1797 that the diamond is elemental carbon. The explanation of what had to be done is comparatively simple. The scientists had only to duplicate the conditions in nature some 240 miles below ground. Carbonaceous materials had to be subjected to the combined high temperatures and high pressures estimated to exist at this level. This meant pressures of 1½ million pounds per square inch and temperatures of 5000 F. The almost unbelievable job of getting these conditions is a closely guarded secret. The United States Government has placed secrecy orders on the patent applications covering the process and the equipment.

The man-made diamonds are generally blocky, rough surfaced crystals, while the natural crushed diamonds (called bort) vary widely in particle shape from flat to blocky, with some elongated particles, and with generally smooth surfaces, *Fig.* 1. This difference accounts for the better performance of man-made diamonds in that the roughness provides a better mechanical support of the crystals in the bond of the

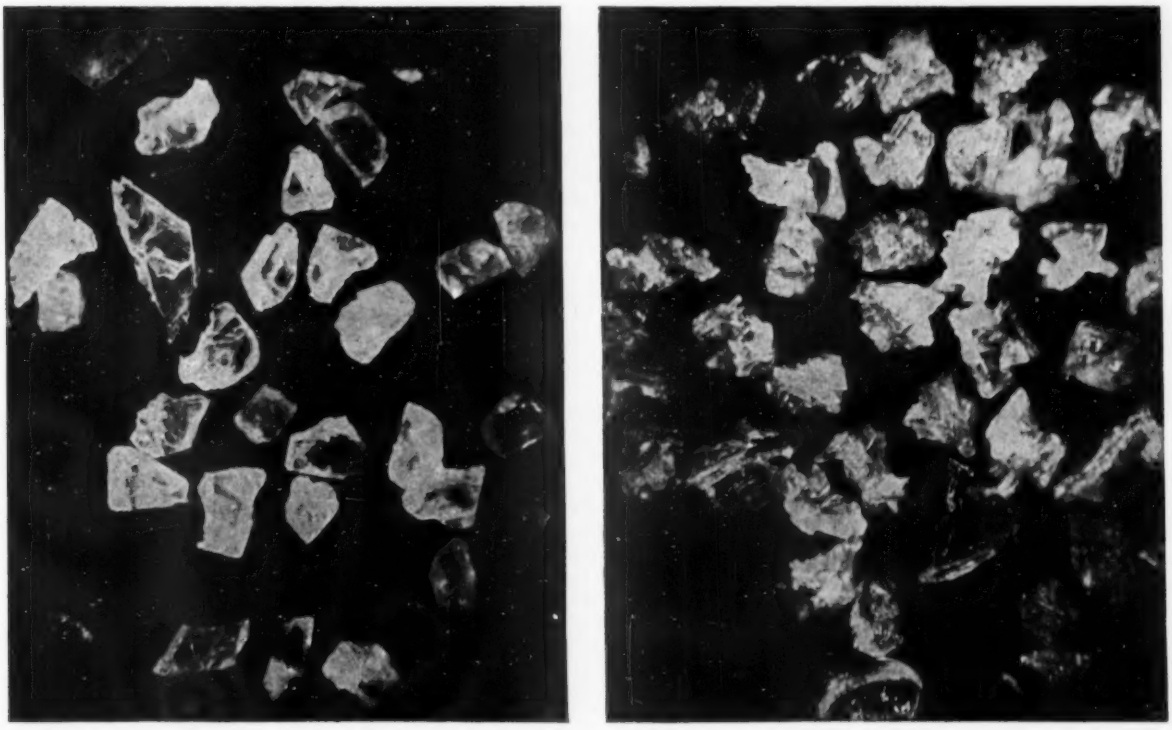


Fig. 1. A comparison of the natural and artificial diamond crystals viewed under a microscope with a magnification of X40. Size of the crystals are 80 to 100 mesh. The natural stones are shown in the picture at the left.

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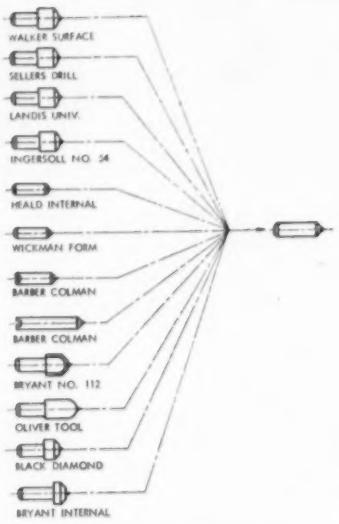


Fig. 2. Method by which twelve tools currently being used by industry can be reduced to one standard.

grinding wheel, resulting in less diamond loss while grinding.

A limitation is price. The price comparison early in 1958 was $3.48 per carat for man-made crystals and $2.80 per carat for the natural bort.

The orienting or positioning of a vector of a diamond so that it will present greater resistance to wear—referred to as "oriented-vector diamond tools"—presents a bold departure from conventional diamond tools. Diamond users and diamond toolmakers have known for many years that a diamond can vary widely in abrasion resistance, depending on the direction of the grain. Visual orientation, the accepted practice, left a wide margin of error. Under that method, some diamonds acted soft; others glazed or loaded the wheels. Still others lacked consistency and required frequent turning.

In the new system, the diamond can be used entirely without turning or resetting on large or small wheels of coarse and fine grits.

In brief, oriented vectors means positive orienting and positioning of the grain or hardness vector of a diamond to give maximum tool life. A slab of scientifically determined cross section is sawed from a high-quality diamond. This slab is then accurately oriented by X-ray diffraction and is precisely transferred to the tool nib by fixtures.

Throughout the years, attempts have been made at standardization of diamond tools, not only by the diamond toolmakers and vendors, but also by various industrial users. Each have somewhat different standards on size and style of shank.

Three years ago, representatives of all the interested parties got together under procedures of the American Standards Association with the result that nomenclature, sizes and styles of diamond tools were agreed upon. ASA Standard B67.1—"Industrial Diamonds and Accessories for Their Use"—is published by ASTE. It does not, however, cover the diamond used in the tool nor the method by which it is set.

However, the standardization of the shank sizes can, in time, produce very substantial savings to users by reduction of diamond tool inventories. B67 was sponsored by the American Society of Tool Engineers with the Industrial Diamond Association as cosponsors. In the committee's investigation, it was found that 131 different shank styles and sizes could be logically reduced to six.

As an example of the manner in which the committee attacked the problem of reducing the number of sizes and styles of diamond tools, see one of the detailed sheets used in selecting the ¼ x 1 straight shank tool, *Fig.* 2.

All of these standard tools will fit directly into the present holders on many of the machines now in use. In some cases minor changes in toolholder design may be required.

Although diamond tool shanks have now been standardized in nomenclature, size and style, the diamond, which is the most important part of the diamond tool, has not. Diamond tools are purchased by many users from diamond tool manufacturers who classify the diamond by price. The higher the price, the better the tool according to this method. Many large users buy selected parcels of diamonds and set them in shanks at their own plants. In either case, the buyer tries to set up some way of determining what he is getting for his money. Many dealers are helping the customer set up some sort of standard. Conclusions:

1. Man-made diamonds can become competitive with bort for use in many grinding wheel applications. Quality is shown to be superior to bort for most grinding wheels, but the price is higher. As production equipment and technique are improved, they will compete.
2. Man-made diamonds will make the United States less dependent upon Africa for diamonds. The supply will be unlimited except perhaps in size of stones.

3. Oriented vector diamond tools will have a definite place in quality wheel dressing, but there will always be a wide field of use for small natural diamonds where a less expensive tool can do the job. Some standard prices of diamonds will be disturbed when oriented vectors become available in quantity.
4. Inventories of diamond tools can be reduced materially by insistence that the tools listed in ASA Standard B67.1 be used in all possible applications. Special shanks will always be required for certain jobs but the customer must insist that machine-tool builders, manufacturers of wheel-dressing fixtures and diamond toolmakers adhere to this standard whenever possible.
5. Industrial diamonds can be standardized nomenclature, shape and quality and the job should be done by the diamond industry with some help from the user.

Based on a paper presented at the Annual Meeting, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Numerical Control

By Myron S. Curtis

VP, Engineering
Warner & Swasey Co.
Cleveland, Ohio

Like the much misused and misunderstood word "automation," "numerical control" covers a great deal of ground. For this paper, I am using it specifically to mean control of machine tools by tape with the control information punched on it numerically. You will say that there are systems of numerical control using punch cards. This is true. But I believe that the punch cards system is on its way out.

It is true, however, that there is a very definite trend towards standardization of numerical control. The trend is definitely toward tape punched digitally (either decimal or binary), the tape being of a uniform width.

All numerical control systems have basically the same components, although these components may vary greatly in complexity. They are:

1. A tape, or cards, of course.
2. A means of putting the information on the tape or card. This may vary from a simple, inexpensive hand punch to a complex computer. This tape preparation mechanism is, of course, outside of the machine tool itself.
3. A tape reader, which takes information from the tape and turns it into commands for the machine.
4. A method of storing these commands until it is time to use them.
5. Servomotors which receive the commands and turn them into machine operations.
6. A play-back system which tells where the machine elements have been moved by the servomechanisms in response to the commands.
7. A method of comparing what the elements have done and what they were supposed to do.
8. A means of correcting their movements if they have not responded properly to the commands.

During the last few years a great deal of effort and a huge amount of publicity have been expended in the research, development and promotion of numerical controls for machine tools. In addition, international interest in electronically controlled devices of all kinds, and recently guided missiles in particular, has focused people's attention on anything of a robot nature for eliminating human thought and effort.

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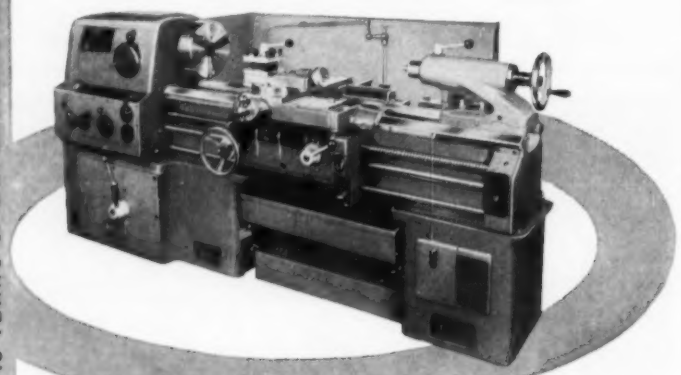
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As a result, numerically controlled machine tools have become glamorized and undoubtedly overemphasized as to their over-all top possibilities—so much so that the average machine tool user is becoming convinced that the solutions to his problems of cost, accuracy, manpower, etc., lie in the adaptation of recorded information controls to his machine tools, and in that only.

The advantages of numerical control lie basically in the fact that it is one of several means of taking the labor and intelligence away from the operator and putting them in the machine itself. In other words, it makes the machine automatic. This provides:

1. A great reduction in "human error" and operator problems — greater accuracy, fewer inspections, less scrap and alleviation of the skilled machine operator shortage.
2. An improvement in time and inventory factors—shorter lead time, shorter setup time, repeatability, a full 8-hour shift per day per machine with no coffee breaks, lunch or fatigue time.
3. Mechanical improvements through constant and correct loading of tools.
4. Extreme versatility.
5. Low inventory of tools, jigs, templates, etc.
6. Remote preparation and storage of control data.
7. Easy changing of control information.

All of the above can be accomplished more or less satisfactorily by methods other than numerical control, and it is wholly a matter of economics as to which method should be used.

However, there is one field in which numerical control stands practically alone, and that is in the machining of complex shapes in small quantities.

Summing up, numerical control accomplishes the following things:

1. The machining of complex shapes accurately and repetitively; in other words, it puts brains into the machine.
2. It has a minimum of setup time.
3. It provides means for removing, storing and replacing control information.
4. The control information can be easily corrected.
5. The control information can be remotely prepared.
6. Tooling is much simplified.

I'd like to give may own views on the future devolpment of numerical control of machine tools, and remember this is my own personal opinion—I may be right and I may be terribly wrong, but I am betting that I will be right.

Five years from now all industries will be using numerical control to a greater or lesser extent. This extent will depend upon the size and complexity of the product and on the cost of

numerical control.

Numerical control is with us to stay, and while it is now in its infancy, it will grow into a lusty manhood. No machine tool builder, no machine tool user can afford to be ignorant of this development and to neglect keeping in touch with its development and application; but it is not a panacea for all manufacturing problems. Like any other development in machine tools, it has to stand on its own feet economically. In one short sentence, if it pays to use numerical control, use it; if it doesn't pay, don't use it.

Based on a paper presented at the Machine Tool Sales Conference held at Purdue University, sponsored by the National Machine Tool Builders Association, 2071 E. 102nd St., Cleveland 6, Ohio.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Hypereutectic Aluminum-Silicon Alloys

By Richard M. Smith
Aluminum Co. of America

Hypereutectic aluminum-silicon alloys are defined as aluminum alloys containing more than the eutectic quantity of 11.6 percent silicon. The foundry characteristics of these aluminum alloys are somewhat less than ideal. While they have excellent fluidity, feeding characteristics are poor and internal shrinkage results if adequate gating and risering is lacking. Controlled foundry techniques are required to handle these alloys successfully. Melting and pouring temperatures must be higher for aluminum-high silicon alloys than for conventional aluminum casting alloys. Suggested pouring temperatures for these alloys are in the range of 1325 to 1350 F for die castings and from 1400 to 1450 F for permanent mold, semipermanent mold and sand castings.

Differences in density of solid silicon and molten aluminum lead to a tendency for gravity segregation, and a coarse nonuniform structure results. The answer to the segregation problem in these aluminum-high silicon alloys appears to be in the German technique of primary silicon constituent refinement. A suitable phosphorus addition to the melt acts to refine the primary silicon crystals, and a relatively fine uniform structure results on solidification.

The phosphorus treatment is not only beneficial to the foundry characteristics of these alloys but affects physical and mechanical properties as well. The termal conductivity of the unrefined alloy in permanent mold casting is about 10 percent higher than that of the sand cast product. Because solidification in a permanent mold is more rapid, the permanent mold casting process produces a finer primary silicon constituent size than does the relatively slow cooling sand casting process. In the refined condition, the casting process has much less effect on thermal conductivity of the aluminum-high silicon alloys.

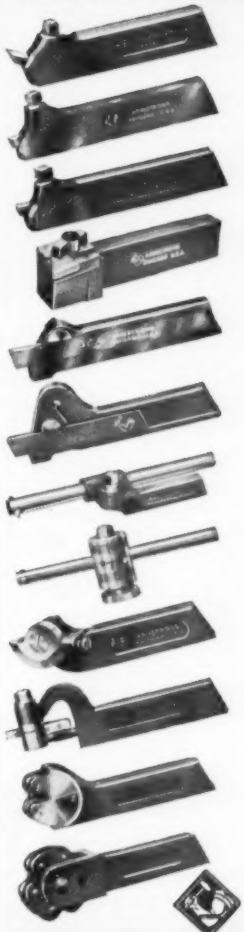
Since silicon is lighter than aluminum and is the major alloying constituent, a low density alloy is obtained.

With regard to growth, the refined material exhibits about twice the growth of the unrefined. However, this relatively low level of growth may be substantially removed with a -T5 type heat treatment of eight hours at 400 F.

The aluminum-high silicon alloy group exhibits a lower coefficient of thermal expansion than is attained by the Lo-Ex type of aluminum alloy for pistons. This reduction is in the range of 15 to 20 percent.

The superior chill available in the permanent mold process evidences a substantial increase in tensile strength over the sand cast specimens. In either casting process, the refinement of the silicon constituent increases the tensile strength of the alloy. The hardness of these alloys is only slightly influenced by primary silicon refinement. The -F condition hardness is good in either sand or permanent mold castings, and Brinell hardness readings in the 130 range are common with heat-treated

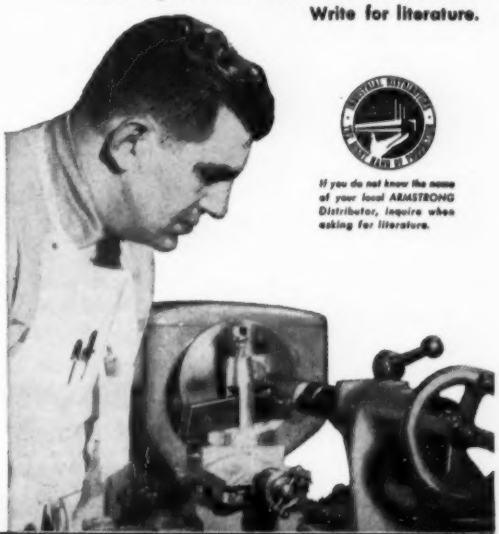
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permanent mold castings.

Generally, the elongation of these alloys is on the order of one half percent and the yield strengths are of the same magnitude as the tensile strengths.

High tool wear encountered with this group of aluminum alloys has been a deterrent to extensive production. The development of tungsten carbide tools eased the machining problem to some extent. Now, with the addition of the foundry technique of primary silicon refinement, machinability is further improved.

The machinability of an aluminum 20 percent silicon alloy was evaluated in a standard machining test. Utilizing radioactive tungsten carbide tipped tools to determine tool wear, refined and unrefined permanent mold and sand cast specimens in the -T5 condition were evaluated. The unrefined permanent mold machining test specimens exhibited one half the tool wear of the unrefined sand cast bars. The benefits derived by primary silicon refinement indicated a sizable reduction in tool wear on specimens made by both casting processes. In the case of permanent mold specimens, tool wear was reduced by 50 percent; the reduction in sand cast samples was about 70 percent. Machining test data on this aluminum high silicon alloy indicated that the wear on tungsten carbide tools was about the same as with high speed tools on 380 die casting alloy.

As far as practical applications are concerned, the aluminum high silicon alloys have been or are being investigated for such parts as pistons, cylinder liners, rocker arms, cylinder blocks, cylinder heads, and brake drums. Products have included forgings, die castings, permanent mold castings, semi-permanent mold and sand castings.

Based on a paper presented at the SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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Practical Methods of Processing Powder into Commercial Strip

By Richard A. Smueker
Application Engineer
E. W. Bliss Co.
Salem, Ohio

The conversion of metal powder to strip by continuous roll compacting, sintering and hot rolling is both practical and economical for certain classes of metal powder.

Chemical methods perfected for producing high-grade metal powders directly from scrap or ores resulted in stirring up interest in the possibility of conversion of metal powders directly to strip.

The continuous conversion process applicable to commercial plant operation uses special designed rolls for compacting metal powder to a uniform density green strip of sufficieent strength to permit easy handling. This green compact is sintered, hot rolled and reeled into coils of essentially 100 percent dense hot rolled band.

The hot rolled band from the conversion line can be cold rolled successfully to thin gage strip. The mechanical properties of copper strip, for example, produced by this method show tensiles and yields that average higher than electrolytic grade copper with elongations equal to electrolytic grade copper. The oxide content of the copper strip from powder is much less than that reported for commercial grade electrolytic copper. Hence, this copper is less susceptible to hydrogen embrittlement and is more easily welded. These factors, together with the small uniform grain size, result in copper strip that is ideal for deep drawing and forming operations.

This process is applicable to most metal powders and may be the answer to the fabrication of some of the

"miracle" metals and special alloys that resist conventional methods of prodution.

Based on a paper presented at the Annual Convention in Cleveland, Ohio, of the Association of Iron & Steel Engineers, 1010 Empire Bldg., Pittsburgh 22, Pa.

▼ ▼ ▼

Nuclear Training Programs for Industry Personnel

By Saul J. Harris

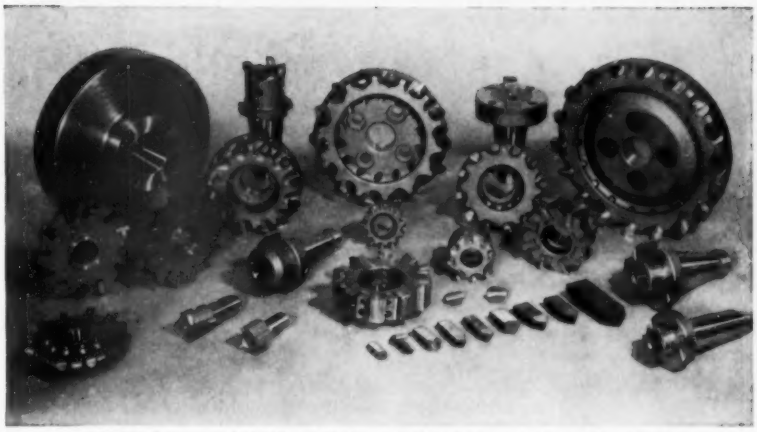
Secretary
Committee on Education
Atomic Industrial Forum, Inc.

Industrial firms engaged in the manufacturing, designing or engineering of nuclear facilities or radiation sources require persons having advanced training in atomic energy which can be put to use primarily in the planning stage. At the present time, most of these individuals are working in mechanical engineering. This was attributed to the comparative degree of effort going into the design and engineering of reactor systems which require a background in materials and mechanical systems. It is possible to obtain graduates in the field of mechanical engineering from accredited institutions, but even these persons required specialized atomic energy education. It can be assumed that manufacturing firms will be required to fill this educational need for some time to come.

The owners of research and power reactors must also have personnel trained in nuclear technology. It is clear that the training of reactor operators must include nuclear physics and reactor safety with the emphasis on the latter.

Radiosotope users must have personnel who will be responsible for the safety of the installation and these persons must be so designated to the AEC in the application for a radioisotope. In addition, the "radiation safety officer" is currently required to "perform dependable radiation protection services and to assume all responsibilities required of him" by state codes.

Operators of power reactors may find their jobs fairly routine and perhaps on the monotonous side. At least we hope that their day-to-day work will result in power levels which remain fairly constant and vary only as determined by the load factor. How is an operator in such a job to be kept in constant alert as to the possible release of atomic



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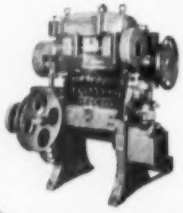
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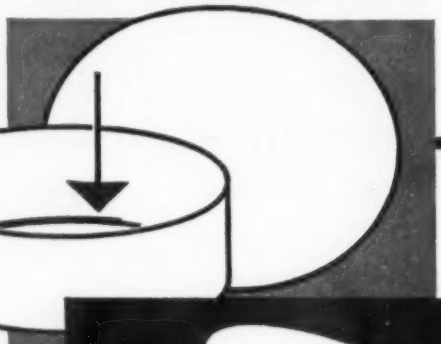
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energy or radioactive material in amounts which may be hazardous to the health and safety of the general public? Should his educational background be as high as the designer?

Operators of research reactors will find the constant changes in power level and operating procedure beneficial in keeping their attention focused on the safety problem. In addition, they will be subjected to constant pressure to manipulate the reactor in new or experimental ways. It can be expected that they also might require a higher professional background in order that they work more closely with persons doing research.

It should be obvious that the major ingredient of nuclear personnel, employed by users of reactors of radioisotopes must be a working knowledge of nuclear processing and radiation hazards must be ingrained.

Regardless of the type of operation an organization is performing in the atomic energy field, it would most certainly like to obtain the services of individuals already competent to a great extent in its field of endeavor. The major sources of supply of trained nuclear personnel are probably familiar to you, but, in brief, are the major AEC-owned installations, the national laboratories, and, in more recent years, segments of the traditional educational system. Depending upon the type of nuclear facility being built, the source of available manpower would be broad or limited.

There seems to exist a great deal of mobility of trained personnel from one company to another in the nuclear design and engineering field with the general trend being away from government services and government-owned industry-run facilities and into industry-owned and operated plants. This mobility tends to provide a broadening effect on the over-all technological competency of the individual and the industry.

For long term training needs, industry seems to be looking toward solving their requirements by:

1. Intergration of nuclear technology into existing college and graduate curricula in all fields, with an emphasis on fundamentals.
2. Stimulating primary and secondary school programs in mathematics and the basic sciences.
3. Providing company on-the-job training and financial support for additional college training during employment.

It may also be concluded that certain atomic energy applications will call for relatively moderate adjustments in

human skills with greatest emphasis in the design, planning and maintenance of atomic installations or sources. We may expect to see a gradual decrease in the percent of atomic energy employees having strong backgrounds in essentially "nuclear" science and technology and, as more and more sources, reactors and associated items of hardware become more widely used, the customary range of skills from technicians through specialists will follow the past experience of other technically oriented industries.

Based on a paper contributed by American Society for Engineering Education presented at the Nuclear Engineering & Science Conference. Published for the Engineers Joint Council by the American Institute of Chemical Engineers, 25 W. 45th St., New York 36, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Multiplying Factors for the Calculation of Hardenability

By C. F. Jatezak
Research Metallurgist
Steel and Tube Div.

D. J. Girardi
Manager
Metallurgical Research and Process Control
Timken Roller Bearing Co.
Canton, Ohio

Hardenability effects of manganese, silicon, chromium, nickel and molybdenum, singly and in combination, were studied in 1.00 percent carbon steels by the end quench test at a quenching temperature of 1700 F and from normalized and spheroidized prior structures. Two different sets of hardenability factors were derived. One set, based on a normalized prior structure, can be used to predict the case hardenability of carburizing steel grades at carbon levels of 0.75 to 1.25 percent, and the other, based on a spheroidized prior structure, is for the hardenability prediction of homogeneous hypereutectoid analyses, such as tool steels. Hardenability factors were obtained for each element to a level of 1.50 percent or higher with the exception of molybdenum whose effect was determined up to 1.00 percent.

Based on a paper presented before the Fortieth Annual Convention of the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Ceramic Adhesives

By Henry G. Lefort
Dept of Ceramic Engineering
University of Illinois
Urbana, Ill.

The need for materials to serve as high-temperature adhesives came about as a result of increased speed of aircraft and missiles. Surface heating developed as the speed of these vehicles increased above mach 1. A great portion of an aircraft's exposed surface was made of organic adhesive bonded aluminum honeycomb panel construction.

Ceramic adhesives are suitable for bonding metals and will, when applied under reasonably controlled conditions, yield shear strengths in excess of 2000 psi at temperatures up through 1000 F. At 800 and 1000 F shear values may be expected to approach 4000 psi. Values such as these represent more than a third the strength developed by organic adhesives at room temperature and they greatly exceed the strengths of organics as the temperature is raised above a few hundred degrees F. It should be noted that the use of ceramic adhesives for bonding metals and honeycomb construction is being actively investigated by most of the aircraft industry's prime contractors and many of the subcontractors in this country, since this method appears to be the most sound and economical solution, especially in bonding honeycomb for high-temperature operation.

The purpose of this paper has not been to thoroughly account for all the factors affecting the strength properties of ceramic adhesives. Instead, it has been attempted to explain the why, how

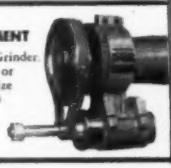
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and what of ceramic adhesives and also to bring attention to some of the variable factors which influence their nature and effectiveness. Honeycomb sandwich construction is a lightweight high-strength material that can be fabricated from any number of metals, and should be a useful enameled product.

Based on a paper presented at the 20th Annual Shop Practice Forum of the Porcelain Enamel Institute, Inc., 1145 19th St., N. W., Washington, D. C.

Standards For Ball and Roller Bearings

By Jerrus M. Bryant
Chief Engineer
Ball and Roller Bearing Div.
Link-Belt Co.
Indianapolis, Ind.

The rapidly accelerating pace in the improvement of communication and transportation in our world society emphasizes the increasing need for dynamic standardization in all areas of human life. Actually, the real need for standardization arrived with our competitive market. Unfortunately (but probably because of necessity at the time) it trailed the market in many, many ways. In the minds of some people, this is as it should be. But with others, a broader concept envisions the accelerated progress that could result through premarket standardization.

One of the few remaining standards lagging behind the competitive market deals with press fit recommendations and radial clearance for roller bearings. These are now being studied, with the hope of reconciling differences. The major resistance to change rests with the inconveniences growing out of catalog changes and the resulting effect on the customer. The first nation on hand with sound national agreement can wield a tremendous influence in the ultimate international standard.

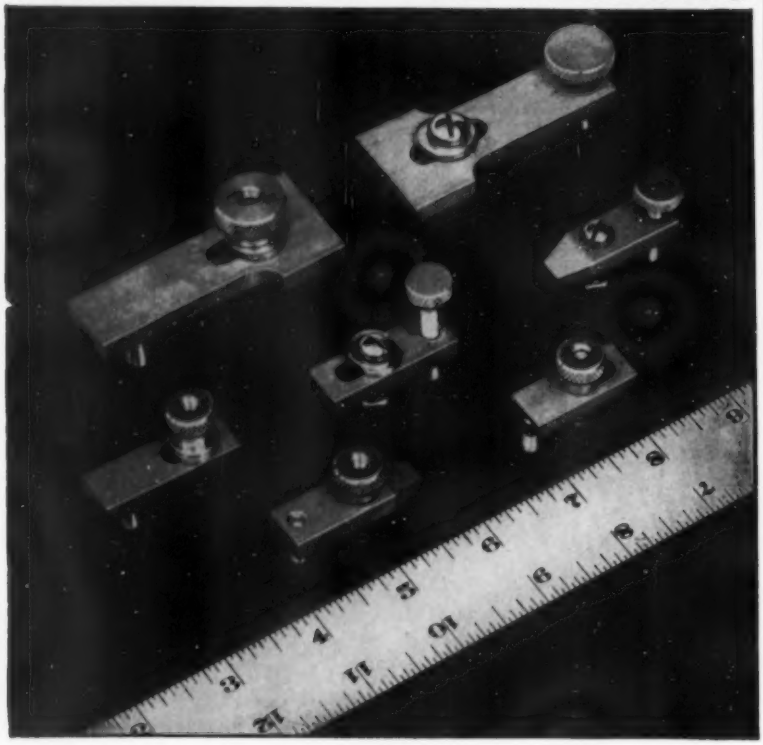
Progress in standardization at any level is contingent to a large extent on procedure and the willingness of a nation to change its ideas for the general good. International meetings over the past several years have pointed toward real progress in world standardization. The sixth meeting of ISO Technical Committee (TC) 4, recently held in Naples, dealt with accessories, airframe bearings, boundary dimensions, identification code, load ratings, tolerances, tapered roller bearings (metric and inch series), instrument bearings, and a few subjects dealing with operating characteristics. Eighty delegates from the countries of Austria, Canada, Czechoslovakia, France, Germany, Hungary, India, Italy, Netherlands, Poland, Rumania, Spain, Sweden, Switzerland, the United Kingdom, the United States, and the USSR took action on 34 resolutions. There were observers from Yugoslavia and International Railways.

However, I should like to sum up three thoughts which directly and indirectly express "what is in it" for the consumer, the producer and the general public when sound, dynamic international standards are developed.

1. International standards, as well as national standards, make it easier for consumers to do business with producers.
2. In the process of developing these standards we also develop a much better understanding of the world market, engineeringwise and businesswise.
3. The pooling of the best engineering talent throughout the world lifts the quality level of our national standards.

Based on a paper presented at the Ninth National Conference on Standards of the American Standards Association, 70 E. 45th St., New York 17, N. Y.

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Small Talk and Man's Industrial Progress

By Louis Polk

President
The Sheffield Corp.
Dayton, Ohio

In using light waves to determine basic standards, we can compare two light beam waves of different spectral lines with errors not exceeding one or two parts in 50 million. But comparing a light wave length with metal gage length is like comparing pepper with peppermint. Thus, Dr. Gardner points out there are some very interesting problems among the possible sources of repetitive errors in reaching for the seventh decimal place.

For instance, the diamond tip of a ⅛-inch radius plunger on a mechanical gage when applied with a pressure of 6.4 ounces penetrates a steel gage to the extent of 100 ten-millionths of an inch; whereas, for a carbide gage, the penetration is only 66 ten-millionths of an inch, indicating a possible error of length amounting to 34 ten-millionths of an inch. Other materials show other variations. For fused quartz, the penetration is 200 ten-millionths. Moreover, light itself seems to penetrate the surface of a steel gage during interferometric measurement, much as the previously mentioned plunger penetration on a mechanical comparator. It's known as the "change of phase," which accompanies surface reflection from light-absorbing materials. This optical effect is less than that of mechanical penetration, often less than 20 ten-millionths and as low as 7 ten-millionths of an inch under most favorable conditions. This degree of penetration is also affected by polish of the gage surface; and, of course, matters get even more confused when you compare quartz with steel—for the two materials obviously reflect differently, yet they must often be compared directly.

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Dr. Gardner also illustrates that, when wringing a gage to a base plate for measurement, the dimensional effect of the wringing interval depends on the character and planeness of the two surfaces, and the average value for the interval is 3 ten-millionths.

Measured in a vacuum, there is a change of 3 ten-millionths of an inch for the length of a 1-inch steel gage, and 9.9 ten-millionths for fused silica. Then, surrounding temperature and temperature change is important, as is even the index of refraction of air. It is helpful to read temperatures to one three-hundredths of a degree.

Based on a paper presented at the Ninth National Conference on Standards of the American Standards Association, Inc., 70 E. 45th St., New York 17, N. Y.

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Some Observations On The Effect Of Automation On Cost Reduction

By A. S. Karrer

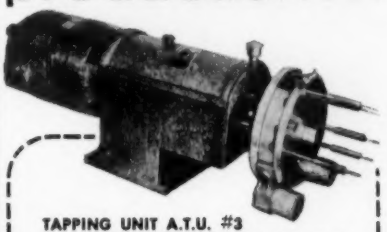
General Electric Co.
Louisville, Ky.

Automation means cost reduction, but this statement should not be thought of as 100 percent pure fact. Some operations do not lend themselves to automation without considerable investment in research of materials and equipment and these costs can very well mean success or failure of an automatic process on a cost-reduction basis. When considering automation, research the project well—(1) look over the current method of operation—is it really as inefficient as it seems? Sometimes, standing too close to the problems prevents recognition of them. Standing back a bit and looking the situation over from a different angle may produce simple ways to save dollars without automatic equipment which might take several years to amortize. (2) Analyze the product—determine whether or not the product design can be automated in the first place and, if so, will the basic design remain stable for a reasonable time after the amortization period of the automatic equipment has expired and the real cost reduction benefits can be realized.

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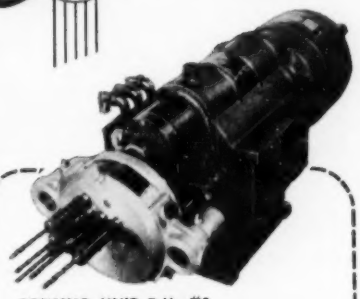
Based on a paper presented at the 20th Annual Shop Practices Forum of the Porcelain Enamel Institute, Inc., 1145 19th St., N. W., Washington, D. C.

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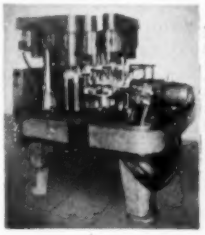
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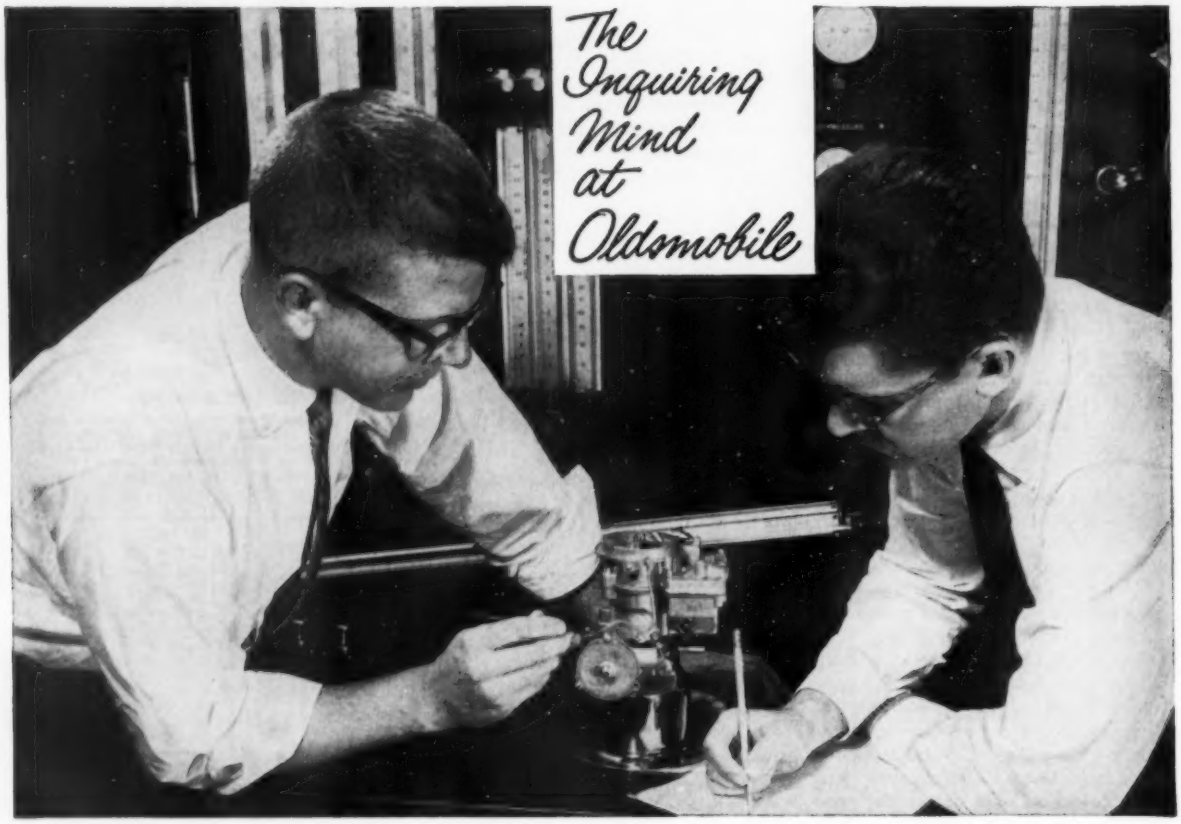
Used singly or in combination they offer the flexibility and adaptability to meet modern drilling and tapping requirements. When combined with Ettco-Emrick multiple spindle heads they'll set new standards of precision, speed and economy.



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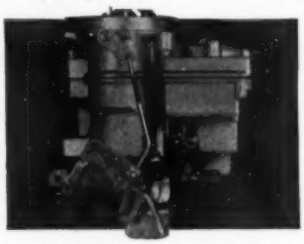
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Unique Oldsmobile-developed two-stage automatic choke is a major step forward in improving automobile operating economy.

One of the important carburetor developments during the past few years was the automatic choke, a device that allows the automobile to be started in cold weather, and then keeps it running until the engine is sufficiently warmed up to sustain itself. Every automatic choke has two separate functions: 1) choking, which enriches the fuel-air mixture for starting, and 2) the idle speed control, which keeps the engine from stalling once it is started. In the past, and on all present carburetors except those used on the 1959 Oldsmobile, these two functions have operated simultaneously with the result that the engine ran on a rich mixture for the same length of time that the fast idle was "on". This resulted in excess fuel consumption.

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Tool Steel Topics

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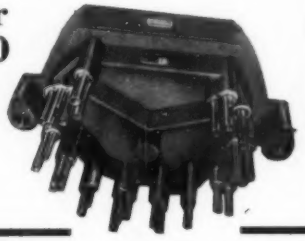
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Precision Tool News

NO. 9 B·S REPORTING NEW DEVELOPMENTS AT BROWN & SHARPE'S PRECISION CENTER



Booklet summarizes features of new B&S tools introduced during 1958

Brown & Sharpe's 20-page booklet entitled "New Precision Tools" is of interest to anyone concerned with tooling or metalworking production. It describes and illustrates all of the latest tools introduced by this company. Improvements in accuracy; savings in time and money; and easy-handling characteristics are spelled out so that the reader can tell what each new tool has to offer him in his own operations. The booklet is available for the asking from your distributor or from Brown & Sharpe Mfg. Co., Providence, R. I.

A few of the latest tools described in Brown & Sharpe's new booklet:

- Convertible Thimble Micrometer provides "friction" or fixed thimble at will.
- Greatly expanded line of "Black Frame" Micrometers offers higher quality at lower prices.
- Hite-Icators and Riser Blocks measure any desired height, quickly, easily, accurately.
- Self-contained, transistorized 36″ electronic Super Hite-Chek reads in .000025″.
- 8″ Vernier Height Gage takes small measurements accurately . . . costs less.
- Complete line of simple and compound sine tools, permanent magnet and inspection types, bring accuracy and speed to angular measurements.
- New, lower, permanent magnet chucks hold better . . . provide greater work clearance.
- Dial Bore Gages and Setting Devices — cover greatest range at lowest cost.
- "Ready Mark" Ground Flat Stock comes pre-colored with non-cracking finish, ready for scribing. Oil-and air-hardening types.

B&S traveling exhibit shows newest tools right at plants . . . welcomes invitations

The B&S "Mobile Precision Center" shows Brown & Sharpe tools to interested personnel at plants throughout the country. It operates on the theory that no one can fully appreciate the excellence of design and ease of usage of a new tool until he's held and used it in his own hands. Tool users agree; in 1958 the B&S truck visited 1000 plants in 48 states, with over 25,000 people attending.



The Mobile Precision Center welcomes an invitation to visit your plant during 1959. Requests should be made as early as possible in the year, through your Brown & Sharpe distributor. All tools exhibited are available to you from his stock — quickly, and economically. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



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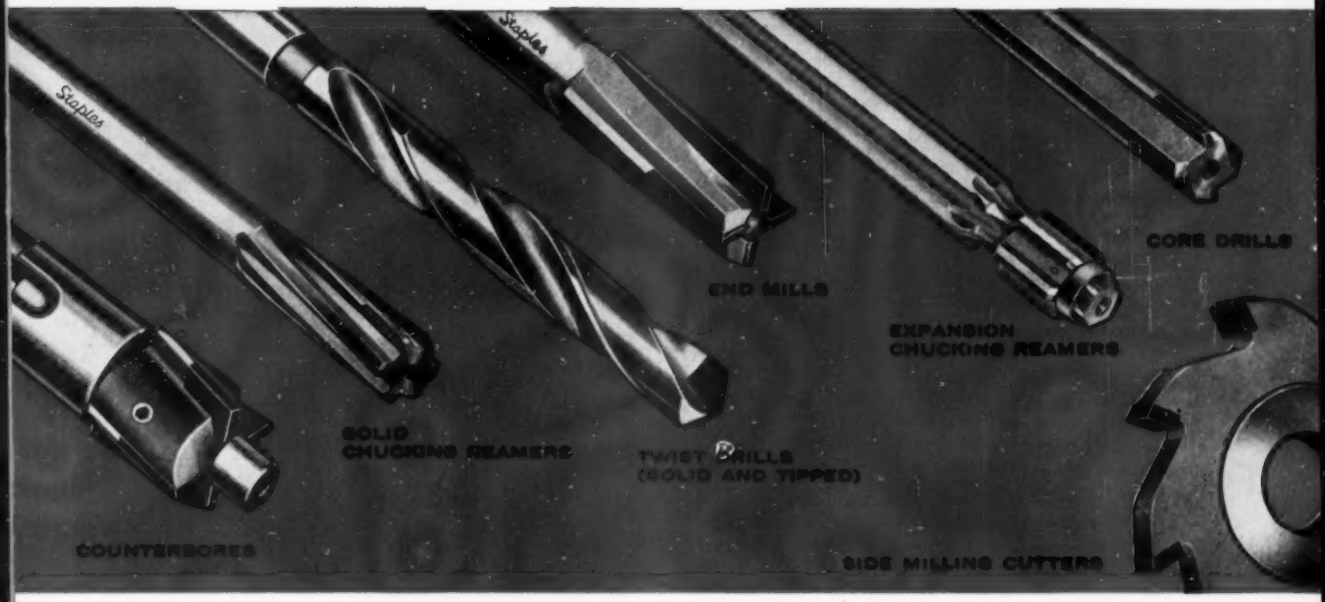
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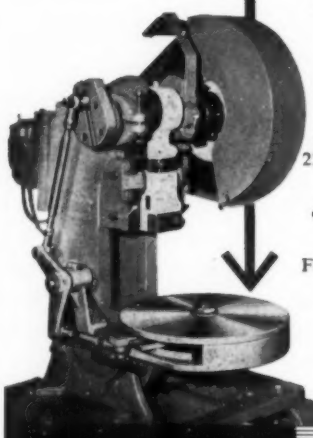
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BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 2

Subject: Screw Thread Classes of Fit:

Screw thread classes of fit have been set up for the purpose of assuring the interchangeable manufacture of screw thread parts. These classes include 1A, 2A and 3A, applied to external threads and 1B, 2B and 3B applied to internal threads. The requirements for a screw thread fit for specific applications can be met by specifying the proper combination of classes for the components. Most requirements however will be satisfied by selecting one of the following combinations:

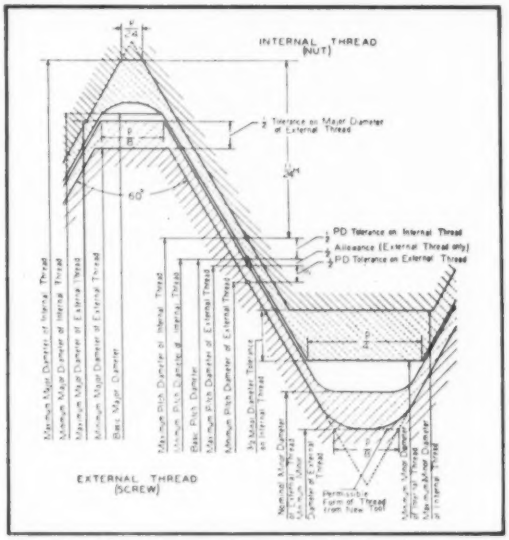


Illustration of tolerances, allowances and crest clearances for classes 1A, 2A, 1B and 2B.

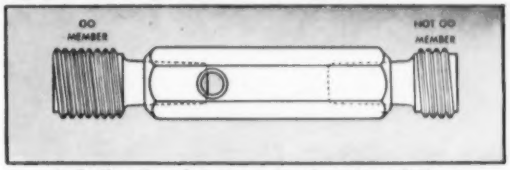
Classes 1A and 1B. These classes, 1A (external), 1B (internal) — are used on threaded components where quick and easy assembly is necessary and where a liberal allowance is required to permit ready assembly, even with slightly bruised or dirty threads.

Classes 2A and 2B. These classes, 2A (external), 2B (internal) — are designed for screws, bolts and nuts. They are also suited for a wide variety of other applications. An allowance is provided which minimizes galling and seizure encountered in assembly and use. It also accommodates to a limited extent, platings, finishes or coatings.

Classes 3A and 3B. These classes, 3A (external), 3B (internal) — are provided for those applications where closeness of fit and accuracy of lead and angle of thread are important. These threads are obtained consistently only by use of high quality production equipment, supported by a very efficient system of gaging and inspection.

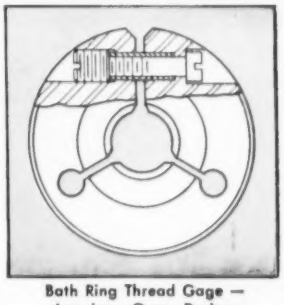
Gaging the Various Classes of Fit

Limit gages are the most effective and economical means for controlling screw thread classes of fit. Maximum metal-limit gages are designated "Go" gages and minimum metal-limit gages are designated "Not Go" gages.



Bath Plug Thread Gage — American Gage Design.

"Go" gages check or control the extent of the tolerance, as applied to a specific screw thread, in the direction of the limit of maximum material and represent the maximum limit of external threads and the minimum limit of internal threads. The ideal gage for internal threads is a "Go" plug thread gage and for external threads, a "Go" ring thread gage. "Not Go" gages control the extent of the tolerance in the direction of the limit of minimum material and represent the minimum limit of external threads and the maximum limit of internal threads. The use of "Not Go" plug thread gages and "Not Go" ring thread gages provides a satisfactory means of gaging for controlling effective size at the minimum material limits.



Bath Ring Thread Gage — American Gage Design.

More simply stated, plug and ring thread gages will satisfactorily inspect threaded components for assembly. Threaded parts will "pass" inspection if the "Go" thread plug will enter the threaded hole and the "Go" ring will thread onto the screw. At the same time, the "Not Go" plug must not enter the threaded hole and the "Not Go" ring must not thread onto the screw more than 3 turns.

Producing Screw Threads in the Popular Sizes



Internal threading is usually accomplished with taps, the pitch diameter or H Limit of which is selected according to the class of fit to be produced. Taps are available as standards in a variety of H Limits and will produce the desired class of fit when used as recommended.

External threading is accomplished with dies, thread milling cutters or other threading tools and the size of the work is governed by the adjustment of these tools.

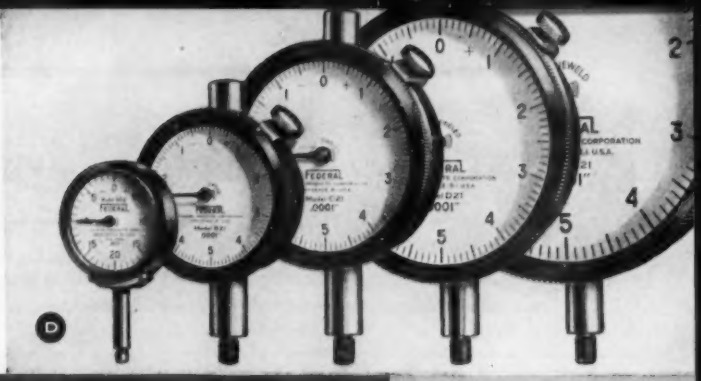
For further reference, see U.S. Dept. of Commerce, National Bureau of Standards Handbook H28 (1957) Part I.

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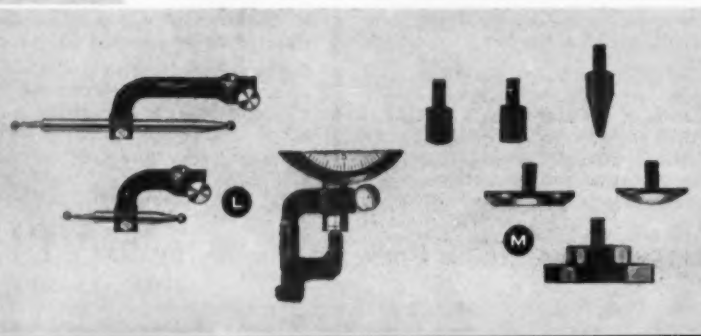
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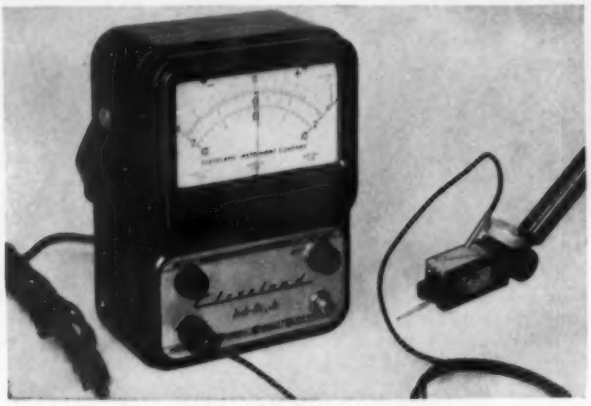
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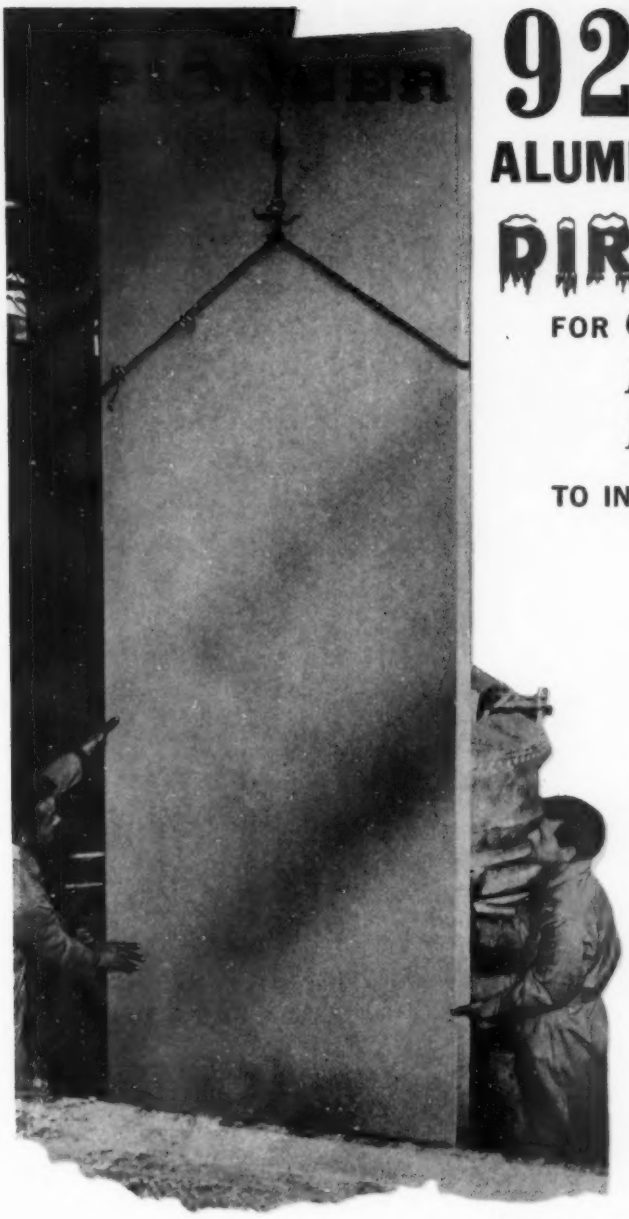
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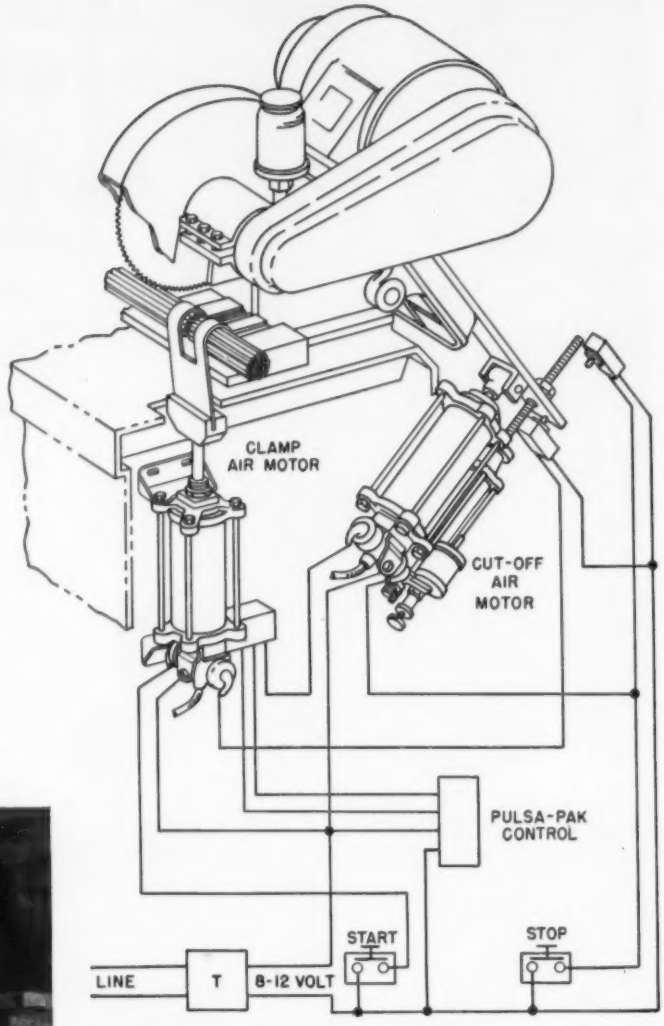
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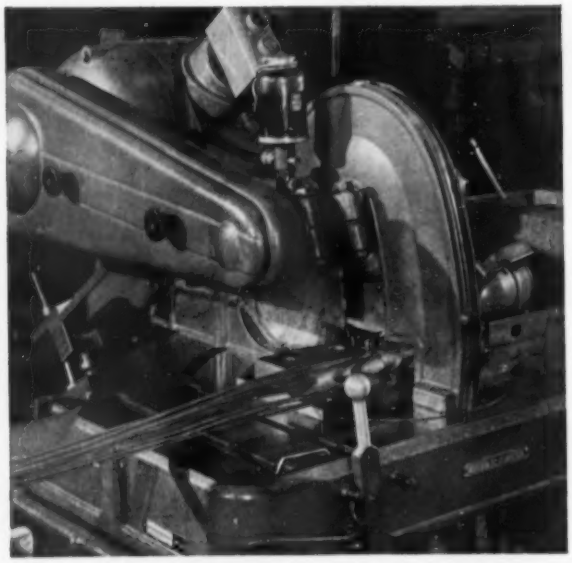
HOW TO MAKE A CUT-OFF SAW PRODUCE MORE AT LESS COST

Shown at the right is a SPOT-A-MATION IDEA used in many plants. Almost invariably it has meant cost savings of 50% or more—has improved product quality, lengthened saw life, lessened worker fatigue.

Two Bellows Air Motors are used. One, hydraulically controlled, feeds the saw through the work. The second clamps the work in position. The two Air Motors are electrically interlocked. The cut-off saw can be made completely automatic by adding a third Air Motor to feed the material.

This is another typical way Bellows Air Motors are used to "Spot Modernize" existing equipment. Almost any hand-fed, or hand-controlled machine can be made to produce more, at less cost, with versatile Bellows "Controlled-Air-Power" Devices.





Typical application of this SPOT-A-MATION IDEA in the plant of Milwaukee Gas Specialties where gas tubing is cut to length. Here costs were cut better than 50% and cost of rejected material reduced 20%.

THIS SPOT-A-MATION IDEA FILE IS YOURS ON REQUEST

Contains drawings, circuit diagrams, equipment list, and full details to enable you to convert existing equipment to lower cost operation. Write for it today. No obligation.

Address Dept. TE-259, The Bellows Co., Akron 9, Ohio.

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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Stuart

Productive Lubrication

FOR PROFIT-MINDED PRODUCTION MEN

VOL. 1, NO. 2 FEBRUARY, 1959

You don't need a lot of different cutting fluids to get the best plant wide tool lubrication

Stuart's ThredKut proves versatility as line oil at Chicago Screw Company

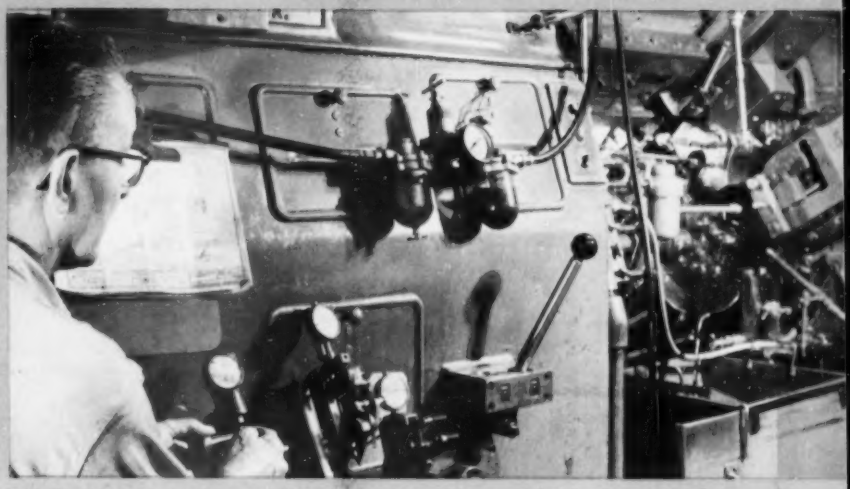
Selection of cutting fluids for constantly changing, diversified machining operations can be a thorny problem. This company, largest of Standard Screw Company's six divisions, met it head-on by making quality and cost the deciding factors. The Chicago Screw Company is one of the world's largest producers of both special screw machine and hot and cold upset products — plus Standard's broad line of Stanscrew Fasteners — and uses a central system for supplying coolants to more than 1,700 machines at its Bellwood, Illinois plant covering an area of over 628,000 sq. ft.

Stuart's ThredKut base at 8:1 is used as a line oil and meets the requirements for most operations. Chicago Screw's central system



Straight ThredKut 99 is used on this Cincinnati Filmatic centerless grinder to grind four diameters in one pass. The part is a special socket head crankshaft screw of alloy steel. An aluminum oxide wheel is diamond dressed by means of a profile cam to produce the desired contours.

delivers this oil to various departments where, if richer or leaner mixtures are required, these changes are quickly made for individual machines. Screw stock may be machined with 12:1 or 15:1 dilutions, whereas form grinding is usually done with a full concentration of ThredKut 99.



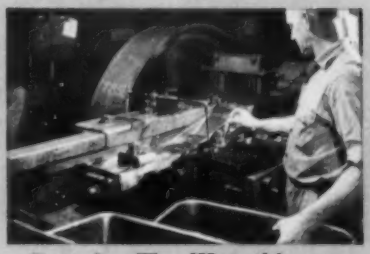
Tool life and finish are important factors in machining this special hex head dog point fastener of C-1141 steel. This precision part is made complete on the Acme-Gridley screw machine and operations include forming, sizing, and thread rolling.

This progressive program has also proved profitable since the company maintains tight control over one of the most vital machining variables affecting tool life, finish, and profit. Many manufacturers not having Chicago Screw's 86 years experience have found themselves catering to operator "whims" or departmental preferences by buying or blending a wide variety of water-mix and straight-oil compounds. This practice can often lead to confusion, waste, and hidden costs.

In a nutshell, the screw machine industry is far too competitive for this leader not to have an intelligent plant lubrication policy. When turning out work on a $50,000 machine,



Chicago Screw has found it is false economy to select coolants that will not provide maximum productivity at lowest per-unit cost.



By using ThredKut, this manufacturer retains complete flexibility for solving a large percentage of its lubricating problems. In handling free-machining materials, for example. ThredKut is used at 15:1 with paraffin oil. In machining tough stainless, a rich 4:1 mixture is indicated. ThredKut's versatility is further demonstrated by the internal broaching of 1018 steel crankshaft couplings ½" in diameter. Fluid film lubrication at the tool-chip interface reduces friction and heat; proper concentration of active sulphur prevents chip welding and eliminates rough surface finish problems.

MORE PL FACTS ▶

Productive Lubrication



New hot die lubricant solves sticking problem

Stuart's Thermex 33 proved to be the ideal "boundary lubricant" for tough forging operations at J. H. Williams & Co., because it prevented metal-to-metal contact, provided maximum plasticity of metal, and eliminated sticking. The result was lower scrap losses, increased production, and longer die life.

Spray of Thermex 33 is electronically metered to the dies between strokes of 3000-ton press. Minimum flash and smoke are important operator benefits.

Thermex 33 was developed for hot forging where heat and pressure are too severe for ordinary lubricants. Quality-controlled graphite is used to provide solid lubrication which resists high temperatures. An extreme pressure additive prevents metal seizure and welding.



SAE 1045 steel blanks are formed into double-flanged roller rims for tractors in a three-stroke 22-sec. operation.

General-purpose lubricant jumps production 200%, belt life 25%..grinding stainless to #4 finish



Belt life was increased 25% by changing to Stuart's ThredKut 99, which is used with belts ranging from 50 grit for roughing to 120 and 150 grit for finishing. Reduction in downtime for belt changing alone uncovered important hidden savings.

Stuart's ThredKut 99 grinding and polishing oil replaced a complex three-oil system which limited production of stainless sheet at Atlas Steels Limited, Welland, Ontario.

This Canadian steel company consistently produces a No. 4 finish on as many as 150 tons of stainless sheet per month on two Mattison abrasive belt grinding and polishing machines, using Stuart's ThredKut 99 as a general-purpose lubricant on all four stages of the grinding cycle.

The combination of high chemical activity for free cutting of tough stainless with extra lubricity provided in ThredKut 99 for production of excellent surface finishes is an important consideration at Atlas. Good scratch pattern and uniform surface finish permit perfect matching of stainless panels placed side by side in construction or assembly.

Production in the roughing operation quickly doubled. ThredKut 99 offered the precise qualities needed for roughing, intermediate grinding, finishing, and polishing to a No. 4 finish. The 25% increase in belt life alone means important reductions in both machine downtime and belt inventory costs. And, one oil instead of three eliminates the possibility of operator mistakes and spoilage.

Considerably fewer flash fires have been experienced during the four years this grinding and polishing oil has been used on the job, with cutting speeds averaging 3600 sfpm. This is due not only to ThredKut 99's higher flash point, but mainly to the fact that less heat is being generated under the positive, free-cutting action of ThredKut 99. ThredKut 99 has a viscosity of 190 sec. at 100°F., assuring excellent belt penetration and thorough "wetting" of the grains.



Stuart's ThredKut 99 is easily applied to the work with a soft bristle brush. Formerly, three special oils were used in four different steps of the grinding and polishing process.

METALWORKING LUBRICANTS

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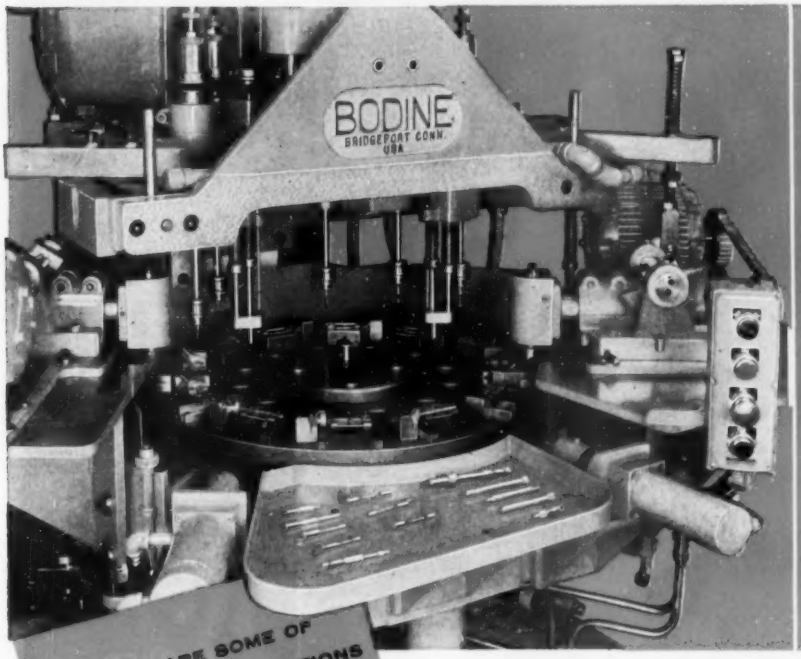
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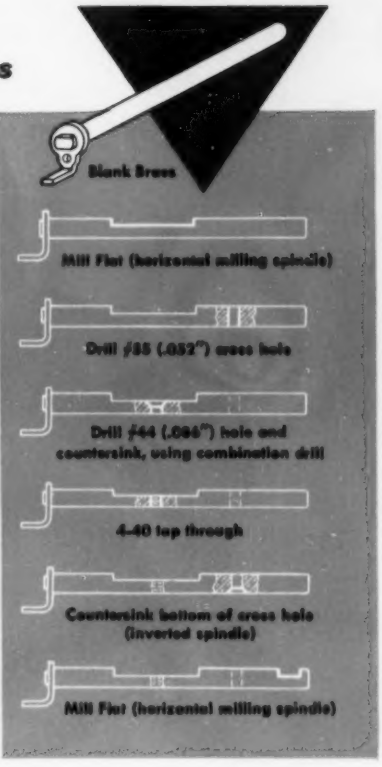
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Bodine case history no. 47

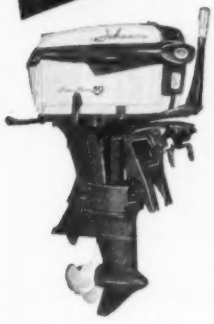
Johnson Sea-Horse throttle shaft in 14 varieties





THESE ARE SOME OF THE MANY PART VARIATIONS HANDLED ON BASIC SET-UP

unique BODINE combination tooling like this is part of the "Sea-Horse" saga



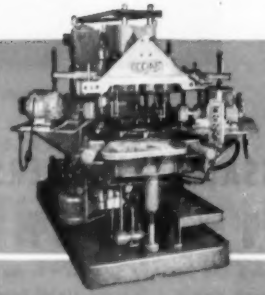
For years Bodine machines and methods have been helping Johnson produce intricate outboard motor parts to high precision standards . . . and within equally close cost limits.

This unusual combination tooling for drilling, tapping and horizontal milling operations is the latest example. No less than 14 variations of these brass throttle, choke and shift parts can be produced on this one machine with fast and simple change-over.

Note the tough holding problem, with holes and flats to be accurately located relative to a crank arm. Note, too, how Bodine swiveling milling heads permit required changes in both width and location of slots. Ready accessibility of tools, indexing table, etc., is obvious. The figures below complete this interesting story . . . and the chances are that Bodine can work out an equally practical and efficient approach to YOUR problem. For further information, write Dept. TE-2.

production data: 550 pieces per 50 min./hr., operating at 11 strokes per minute with manual load and unload.

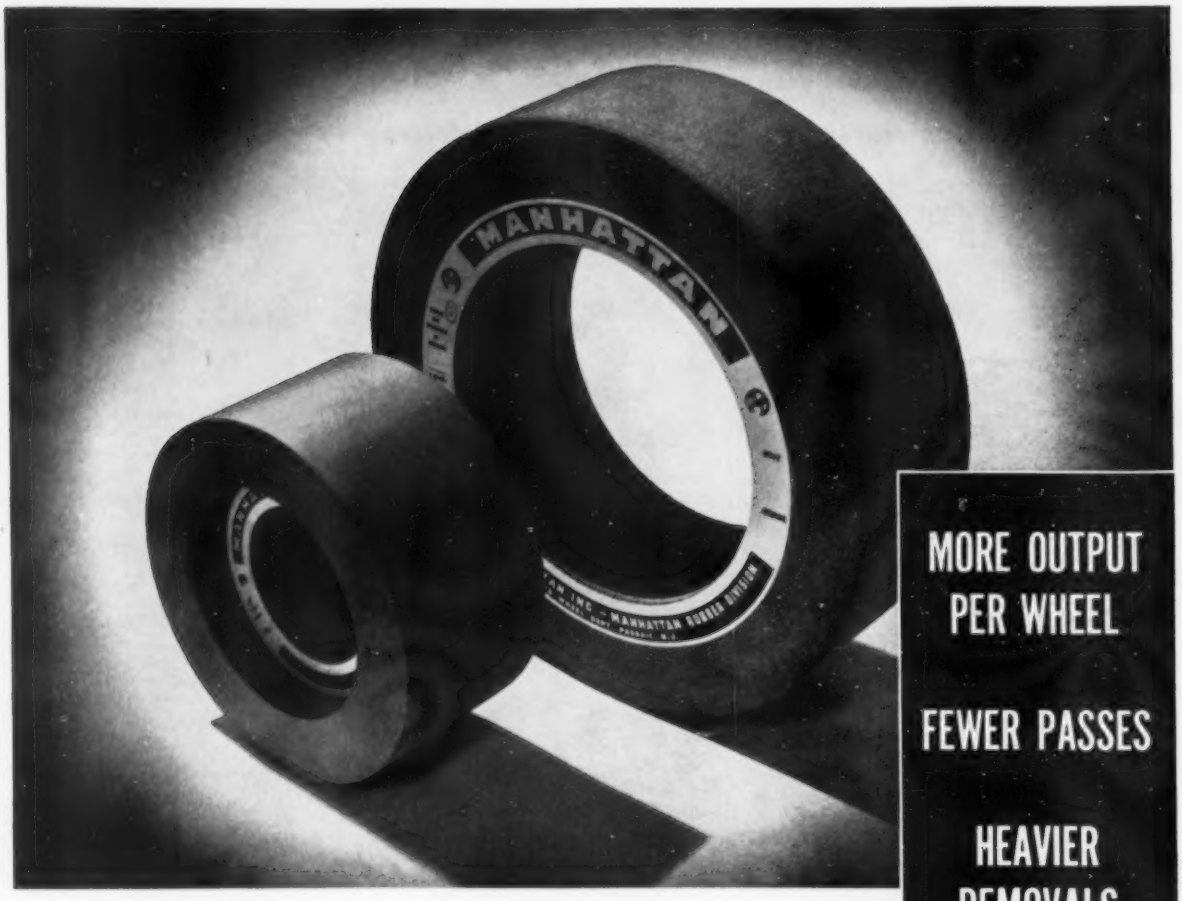
SBD57



This tooling uses the basic Bodine 42-30 Machine with standardized spindles and horizontal milling attachments. Note how compact this production unit is, requiring only 7' x 8' of floor space.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES



MORE OUTPUT PER WHEEL

FEWER PASSES

HEAVIER REMOVALS PER PASS

BETTER FINISHES

LONGER WHEEL LIFE

ROUGHING AND FINISHING WITH the Same Manhattan Centerless Wheel

Finishing operations can be done with the same Manhattan Centerless Wheel used for roughing . . . simply by controlling the feed rate and the amount of stock removed! Manhattan's special natural and synthetic rubber bonds account for this important time and cost saving advantage. High grit-carrying capacity of the bond permits *more* metal removal with *fewer* passes — produces the desired finish to the most rigid dimensional tolerances. No need for time-consuming wheel changes with Manhattan Centerless Wheels. For thru-feed work, you can't buy more grinding efficiency and economy, nor at higher cost!

Manhattan Rubber Bonded Centerless and Regulating Wheels are engineered to meet specific requirements of your centerless grinders. Regulating Wheels are supplied either plain or core-mounted. Manhattan Core Mountings can assure substantial savings in wheel costs. Let a Manhattan representative show you how you can get "More Use per Dollar" with Manhattan Centerless Wheels . . . and other types of high speed, heavy duty abrasive wheels.

RM082

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. . . states Mr. Creighton Blanchard, toolroom superintendent at New Hampshire Ball Bearings, Inc., Peterborough, New Hampshire

THE NEW, IMPROVED THOMPSON TYPE D HAND FEED

SURFACE GRINDER

is winning enthusiastic approval wherever precision work is required



Here's what Mr. Blanchard has to say about the new Type D machine:

"We have three grinders in our toolroom—a Thompson and two competing machines. In our general toolroom grinding, especially on carbide and hard metals, we find the Thompson Type D so superior that we have recently purchased another Thompson just like it. All our precision work goes on the Thompson."

Compare these features

- Steel roller anti-friction slides eliminate ball creep and increase rigidity.
- 14" standard vertical capacity under 7" wheel at no extra cost with no loss in vertical capacity when using wet attachment.
- Solid support through entire length of bearing quill assures extra fine finish.
- 5 inch table movement per turn of handwheel improves quality of finish and speeds up operations.
- No backlash, anti-friction ball nuts and screws on cross feed prevent wheel from creeping away from work in shoulder grinding.
- Swing-out stop for table dog contact permits quick movement to wheel dresser.
- Immediate delivery available.

Send for descriptive literature on the new Thompson Type D Grinder.

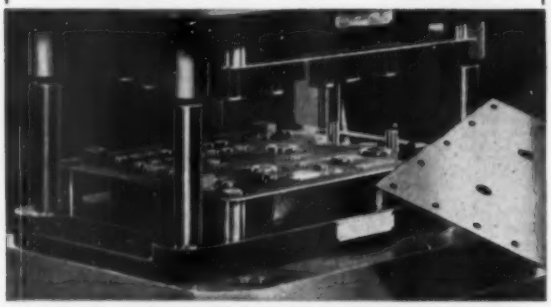
THE THOMPSON GRINDER CO.
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"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

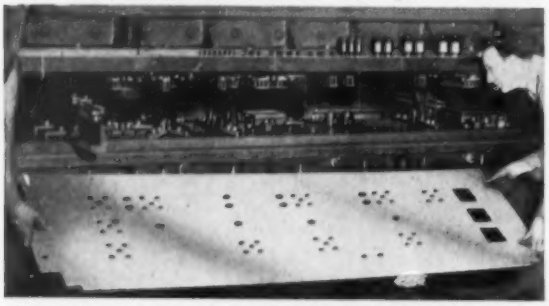
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OVER 2700 PLANTS
are saving money with
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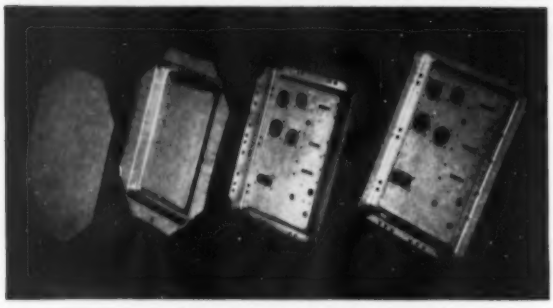
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Mail the following: ☐ Magna-Die Catalog ☐ Adjustable Die Catalog
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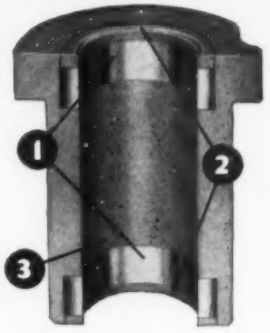
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Can Cut Production Costs!

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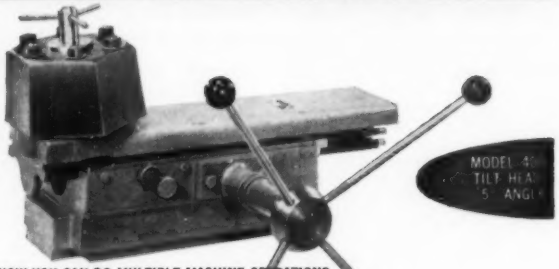
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NOW YOU CAN DO MULTIPLE MACHINE OPERATIONS

The extra heavy duty AK Bed Turret will convert your engine lathe into a ram-type turret lathe for production that would normally require several machine operations. This heavy duty, self-indexing, precision bed turret with six station mechanite head, has been specially designed and engineered for the larger lathes in the 13" to 16" range.

Two models to choose from, either the straight ram or the tilt head ram (5° angle). The tilt head model allows greater clearance over the ram, enabling larger tools to be utilized.

All tool holes are blank to permit user to align them with spindle hole. Complete instructions furnished for mounting turret and machining holes.

- **Manufacturer of PRE COR TOOLS: Collet Closer Attachments.**
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OTHERS AVAILABLE - 10" TO 16"

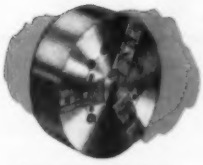
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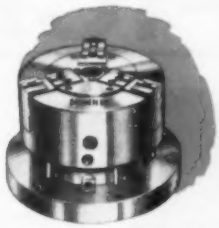
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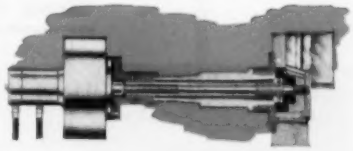
POWER CHUCKS

Provide positive gripping power. Assure accuracy within .001" on diameter on repetitive work. Available in self-centering, combination, serrated jaw, compensating, lightweight self-centering types and in sizes from 6" to 24" diameter. Mount directly on American Standard Type A-1, A-2, B-1 and B-2 flanged spindle noses.



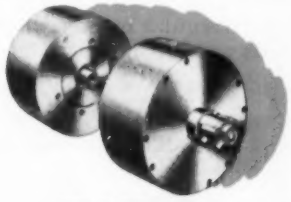
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Non-rotating. Hold work for drilling, milling, assembly operations. Air-operated for fast, effortless loading and unloading. In sizes from 5" to 24" with either two or three adjustable or non-adjustable jaws.



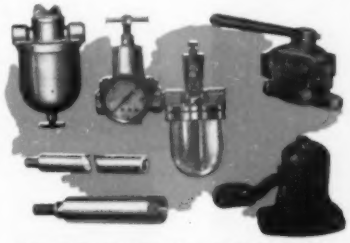
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Designed to convert small lathes to high production power units. Case histories show users make worthwhile savings. Complete unit includes double-acting air cylinder, adapters, regulator, valve and self-centering chuck with 1/4" to 6" capacity. Components may be purchased separately.



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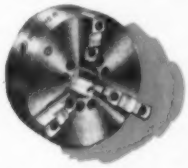
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A complete line of power chucking accessories is available: Hand and foot operated valves, draw bars and tubes, air filters, complete air units.



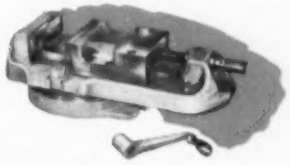
+GF+ WORK DRIVERS

Fastest, surest way to drive 1/4" to 8-1/16" rough or smooth blanks between centers. Used instead of driving dogs. Mount on spindle of any lathe by means of adaptor plate. Engage and disengage workpieces quickly. Positively will not loosen. Have no protruding parts. Hood completely covers jaws. Drivers will work in either direction.



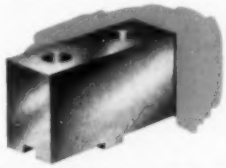
HAND-OPERATED CHUCKS

A large selection of Independent, Self-Centering and Combination chucks. Sizes suited to machines ranging from bench lathes to engine and turret lathes in sizes up to 36". Both direct mounting types and types for use with intermediate adaptor plates.



FULL CAPACITY TROUGH VISES SERIES F AND FS

A complete line of big capacity vises from 4" to 8". Available with or without swivel base. Opening capacity is equal to full width of jaws. Tremendous holding power for rough or finished work. Built-in trough returns coolant to machine table.



SOFT BLANK TOP JAWS

A complete line of medium and heavy duty blank jaws accurately machined to American Standard jaw dimensions. Jaws are low carbon alloy steel which can be carburized and heat-treated to the required hardness—available tongue and groove and serrated jaw types.

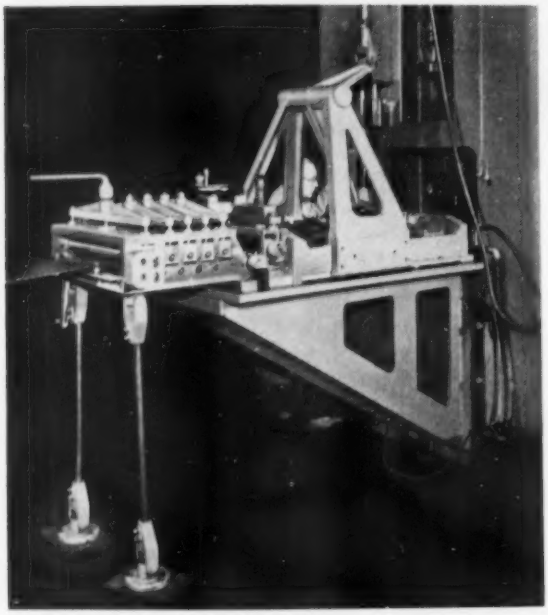
Skinner Products are sold through leading Industrial Distributors and Machine Tool Builders and Dealers.

THE CREST OF QUALITY

SKINNER CHUCKS

ESTABLISHED 1887, NEW BRITAIN, CONNECTICUT

TEAMED FOR PRESS ROOM EFFICIENCY



U. S. Automatic Press Room Equipment is made to team perfectly with your present presses. All units are engineered and built solely to increase the efficiency of your presses — to bring you the savings which result from the use of coil stock.

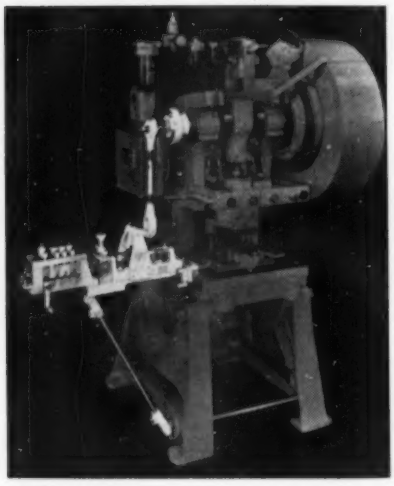
U. S. mechanical driven Slide Feeds have long been recognized by users as the most accurate automatic feeds on the market. They are built in a range of sizes with width capacities from 1½" up to 27", and all sizes can be teamed with matched Plain Stock Straighteners.

Where wire of round or irregular cross-section is to be fed, U. S. Slide Feeds are supplied with Two-way Wire Straighteners.

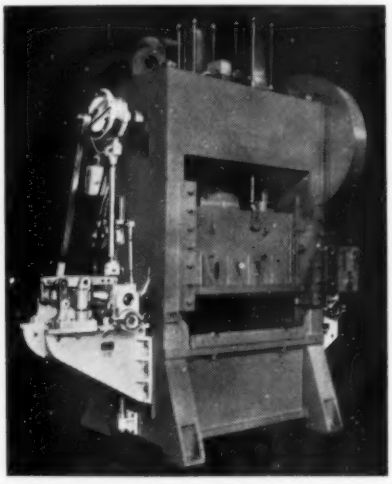
For certain applications, where roll feeding is desirable, U. S. Roll Feeds are available in either single or double types.

Whether you are working with .020" wire or wide flat stock, when you have U. S. equipment you have the perfect team for both short and long run jobs.

SF-2424 U. S. Slide Feed with an SS-24-8 Plain Straightener, mounted on a straight side press to feed from left to right. This combination is capable of handling stock up to 24" wide — maximum length of feed is 24".



Model SF-1 U. S. Slide Feed with matching Plain Straightener, for stock widths up to 2½"— maximum length of feed 4".



Model RF-1212 U. S. Double Roll Feed (Racks and Pinion Type). Capacity: for material up to 12" in width, feed length adjustable up to 12".

US PRODUCTS

Slide Feeds
Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Die Sets
Multi-Slides®
Multi-Millers®
Wire Straighteners
Combination Cradle Straighteners
Combination Reel Straighteners

Complete information about U. S. Automatic Press Room Equipment is yours by asking for Bulletin No. 85T.

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

For Top Metal Cutting Efficiency

. . . Cincinnati gives you a choice of 5 Cutter and Tool Grinders

Whatever is good for the cutting edge of your expendable tools is good for production. And CINCINNATI® Cutter and Tool Grinders are certainly good for the cutting edges of all types of milling and die sinking cutters, reamers, hobs, taps and others. There are 5 machines in the Cincinnati group. They constitute an exceptionally strong secondary line of production equipment for machine tools of all types. Sweet's Machine Tool File contains brief specifications, and complete data may be obtained by writing for catalogs.

MILLING MACHINE DIVISION
The Cincinnati Milling Machine Co.
Cincinnati 9, Ohio



CONTOUR
Cutter and Tool Grinder
Catalog No. M-1918-1



NO. 2
Cutter and Tool Grinder
Catalog No. M-1914-4



NO. 1
Cutter and Tool Grinder
Catalog No. M-1852-3



MONOSET
Cutter and Tool Grinder
Catalog No. M-1591-4



PROJECTO-FORM
Grinding Machine
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CINCINNATI®

KNEE TYPE MILLING MACHINES • BED TYPE MILLING MACHINES
DIE SINKING MACHINES • CUTTER AND TOOL GRINDERS

NEW!

Fastest-Changing Toolholder

SANDVIK Coromant T-MAX



With Exclusive "Autolift", Triple-Purpose Low Cost Chip Breaker

52 NEW SIZES!

In A Wide Variety of Styles

—Positive Rake and Other Popular Holders



Loosen, change, tighten... and you're back in production. It's as quick and easy as that with Coromant T-Max... *newest*, fastest throwaway-type, carbide toolholder on the market.

Only T-Max enables you to change either or *both* the carbide cutting edge and depth of cut *without removing or replacing chip breaker.*

When set screw is loosened, a spring-loaded pin automatically lifts and holds chip breaker against clamp—lets you change or index insert with no waste motion. When changing cut, a push with the wrench clicks the solid carbide chip breaker into desired position for light, medium or heavy cut.

- Precision-made recess seats insert *accurately*—insures machining precision.
- No protruding parts—two or more holders easily clamped together.
- Shank of heat treated alloy steel, HRC 50, guards against damage. Special SR treated, anti-rust finish.
- Precision cast, alloy steel clamp is streamlined for free chip flow.
- Low cost chip breaker cuts replacement expense.

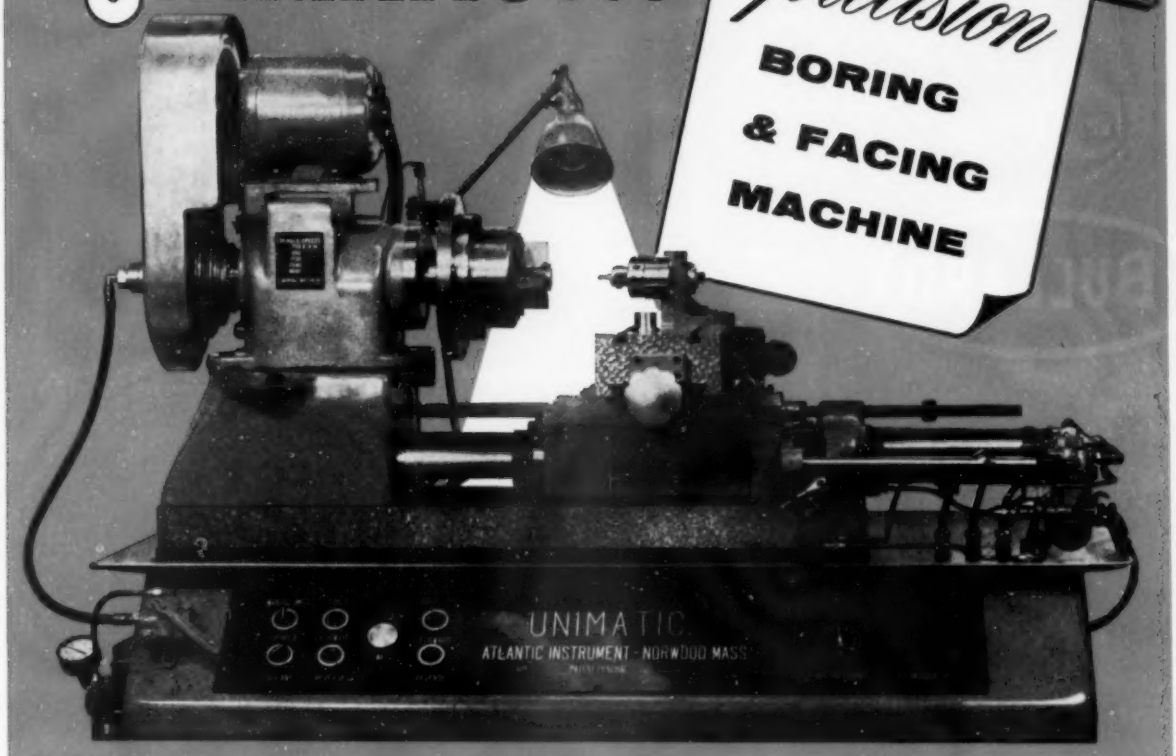
SEND FOR NEW, FREE BOOKLET
Covering various T-Max Styles and other data... or contact your nearest Coromant office or distributor for a T-Max demonstration today.

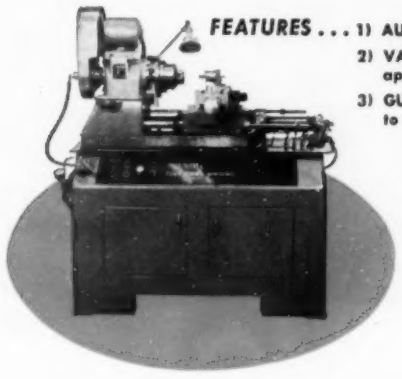


Coromant Division SANDVIK STEEL, INC.
1702 Nevins Road • Fair Lawn, N. J.
Tel. SWarthmore 7-6200—In N. Y. C. ALgonquin 5-2200
CLEVELAND • DETROIT • CHICAGO • LOS ANGELES
SANDVIK CANADIAN LTD P. O. Drawer 1330, Station O, Montreal 9, P. Q.
FROM ORE TO FINISHED PRODUCT WITHIN THE SAME COMPANY
*Patent Applied For
SS-167R

UNIMATIC...

HIGH *precision* **BORING & FACING MACHINE**





FEATURES . . . 1) **AUTOMATIC CYCLING**
2) **VARIABLE FEED** approaches and returns
3) **GUARANTEED** to hold work to .0002"

Designed and built by ATLANTIC INSTRUMENT COMPANY for their own use . . . and now offered as a type and size of machine for which there is a strong demand, especially in the instrument and allied industries, where close tolerances must be held.

The UNIMATIC *comprises an extremely accurate machine element, mounted on a granite base scraped to a tolerance of .00005", with other features (fully explained in our catalog) neutralizing the effects of temperature variations.*

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

"We are WELL SATISFIED with our

BULLARD

Cut Master V.T.L., Model 75

Extreme accuracy is mandatory for a number of machining jobs at the Fuller Company, Manheim, Pa. For example, according to Mr. M. L. Strayer, Machine Shop Supt. "the largest volume piece we process on our Cut Master, Model 75, is the facing of seats for cement diverting valves. They must be perfectly flat. This critical operation is done so accurately on the Bullard Cut Master, Model 75, that with a little hand lapping we have an airtight joint."

This machine has a 24" extra high bed, speed range 6.8 to 250.0 R.P.M. Equipped with 5 sided Turret Head and 4 sided Side Head, both hand indexing, 4 jaw hand operated chuck.



This "built-in" accuracy, which is inherent in every Bullard Cut Master V.T.L., Model 75, can be applied to your work.

CALL YOUR BULLARD SALES OFFICE
OR DISTRIBUTOR FOR THE COMPLETE STORY

THE BULLARD COMPANY

BRIDGEPORT 9,
CONNECTICUT

CHUCKING METHODS CAN BECOME OBSOLETE TOO!

retool with Cushman

AIR OPERATED CHUCKS



Designed and built to fully meet modern machining techniques and machine tool requirements, Cushman Chucks permit the use of higher speeds with heavier feeds, maintaining closer tolerances with continued repetitive accuracy and result in maximum workholding efficiency with the greatest savings in time and costs.

For profitable machining through the use of precision chucking equipment, specify Cushman Air Operated Chucks.

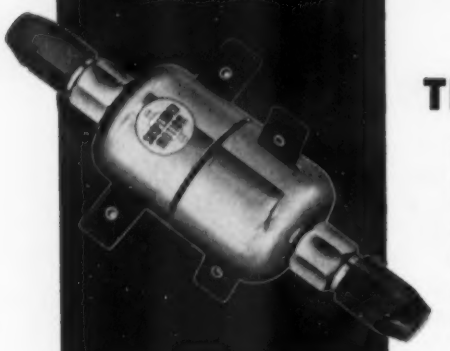


CUSHMAN CHUCKS,
a product of American quality, labor and materials.

THE CUSHMAN CHUCK COMPANY • HARTFORD 2, CONN.

Sold through your industrial distributor

SUSPENDED MOTION





Pull lower tabs to start gaging.

a new concept in thread gaging!

THE FOSTER GAGE HANDLE

Now, **for the first time,** it is possible to inspect tapped holes **fast,** without sacrificing gage life or operator "feel" and speed control with the new Foster Gage Handle.

When gaging, the entire weight of the Foster Handle is **suspended** at all times while in **motion.** And while the gage is in motion, it is impossible for the operator to rest his hands upon it.

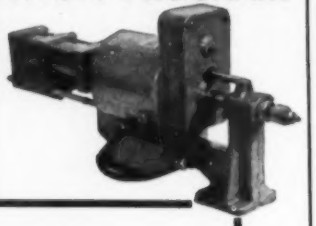
For a demonstration, write to us for the name of the authorized distributor in your area.

C. E. FOSTER GAGE CORPORATION
5341 ENGLISH AVE. INDIANAPOLIS, IND.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-214-1

NOW THREE SIZES OF E-M DRILL UNITS FOR YOUR AUTOMATION PROGRAM

3/32" Capacity
Model 111
1,000 to 10,000 RPM or 2,500 to 15,000 RPM.
Continuously Variable speed control.



¼" Capacity
Model 113
15 Speeds—
750 to 15,800 RPM.

½" Capacity
Model 603
600 to 4,000 RPM with Variable Sheaves.

Electric Motor Spindle
Air-Hydraulic Feed
Write for literature and prices.

The ELECTRO-MECHANO Co. 175 E. Erie St. Milwaukee 2, Wisconsin.

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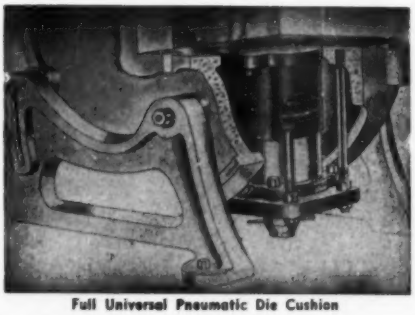
DIE CUSHIONS

by Dayton Rogers

FOR ALL PUNCH PRESSES

to assure accurate working pressure on all dies

- Single or multiple installations standard or designed on the job.
- Best possible delivery.
- Quotations on request.



Full Universal Pneumatic Die Cushion

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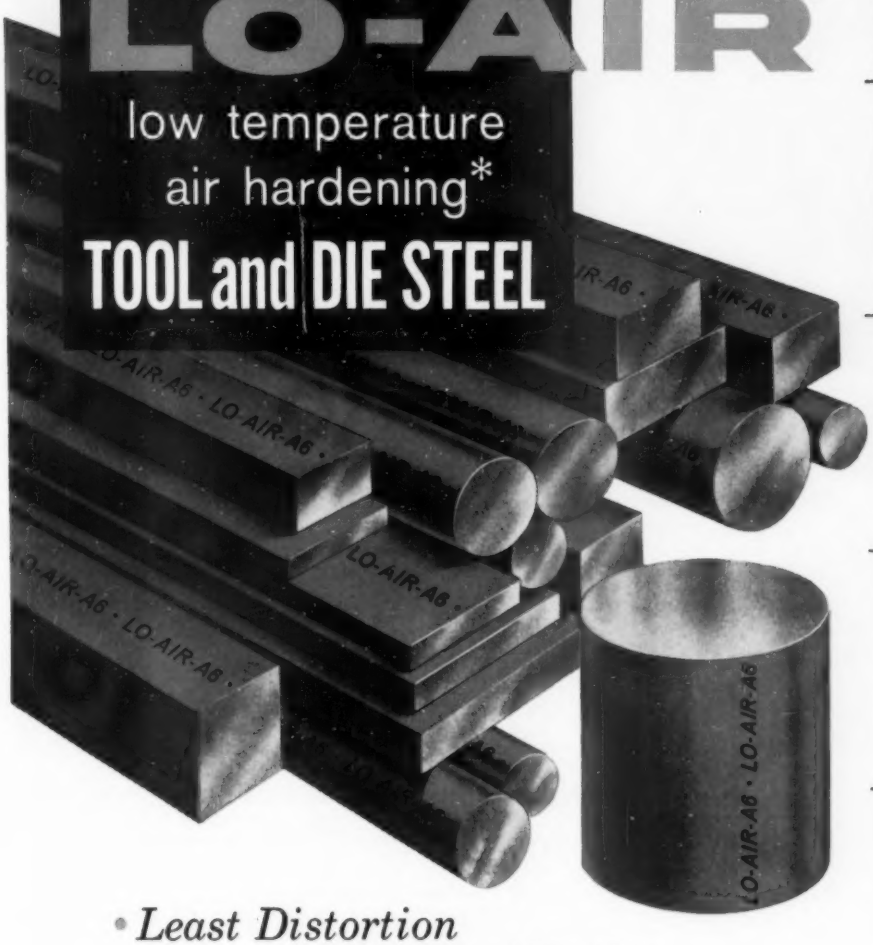
DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7R, MINNESOTA
USE READER SERVICE CARD; INDICATE A-2-214-3

Announcing...

LO-AIR®

low temperature
air hardening*
TOOL and DIE STEEL



- *Least Distortion*
- *Easy to Machine*

New from Universal-Cyclops, LO-AIR is an air hardening tool steel remarkably free from distortion in hardening. Even more remarkable is its ease of machining. Now you can combine the simplicity of hardening and ease of machining typical of oil hardening tool steel (AISI 01) with the safety of an air hardening grade. Write for our descriptive brochure No. TS-101, or better yet order a bar from your nearest Universal-Cyclops sales office or warehouse. Complete stocks are available.

**U. S. PAT. NO. 2,355,244*

UNIVERSAL CYCLOPS
STEEL CORPORATION
BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

BLANKING
STAMPING
TRIMMING
COINING
EMBOSSING
PUNCHING
PIERCING



Parker-Kalon has everything. The most complete line of socket screws in the industry and instantly available from your local P-K® distributor.

Top quality and dependability, too. For example, P-K Dowel Pins are precision ground, positively dimensionally accurate. The development of Parker-Kalon's specially heat-treated pin answers the need for maximum holding power in assemblies where parts must be accurately positioned and held in absolute relation to one another. Available in .0002" standard oversize and .001" oversize for repairs, they assure perfect alignment and facilitate quick disassembly and reassembly of parts in exact relationship.

The same high P-K Standards apply to Parker-Kalon SHOULDER SCREWS, SET SCREWS, FLAT HEAD CAP SCREWS, BUTTON HEAD CAP SCREWS, PIPE PLUGS and the *new* P-K PRE-LODE . . . the socket head cap screw with the increased bearing surface under the head that gives greater load carrying capacity and permits high tightening—full pre-loading—with no danger of marring or indenting softer material.



KEY SET No. 111 contains 11 sizes of most popular HEX KEYS (Short Arm Series) in a convenient steel case, with easy-to-use key island and simple Table for quick key selection for all types of socket screws.

KEY SET No. 45 offers same 11 Hex Keys in a durable, compact plastic pocket case.



Ask your P-K Industrial Distributor to show you samples of P-K Socket Screws...the industry's most *complete* line!

PARKER-KALON®
Socket Screws

PARKER-KALON DIVISION, General American Transportation Corporation, Clifton, New Jersey. Offices and Warehouses in Chicago and Los Angeles

KEEP AMERICAN INDUSTRY AT WORK, BUY P-K, MADE IN THE U.S.A.

At Pipe Machinery...

Times Change, But Never Ideals



Quality, Precision and Service Are Still Our Watchwords

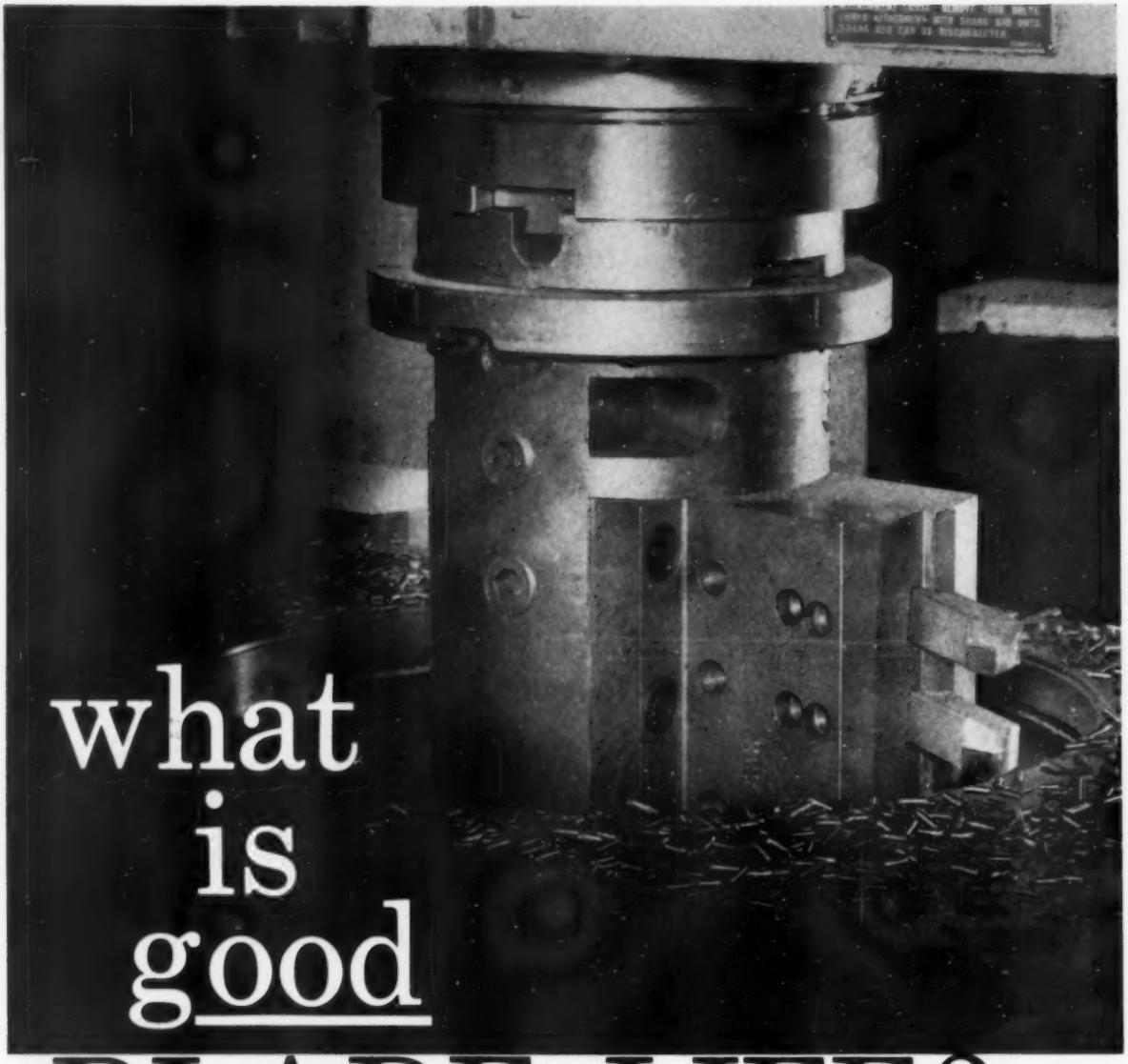


There's a world of difference between that simple one-room frame building where William G. Benninghoff started The Pipe Machinery Company in 1912 and our present spacious, well-equipped plant.

Yet, some things at Pipe Machinery don't change. We have never lost sight of the basic ideals of quality, precision and service which were the watchwords of our founder forty-six years ago. Today, every man and woman in our Gage Division is dedicated to the ideals of Mr. Benninghoff ...dedicated to the manufacturing of gages of unsurpassed accuracy and durability — and to their prompt delivery.

We invite you to get acquainted with our team of devoted craftsmen. Stop in and visit us next time you're in Cleveland.

THE PIPE MACHINERY COMPANY • *29100 Lakeland Blvd.* • *Wickliffe, Ohio* • *Greater Cleveland*



what is good BLADE LIFE?

It could be minutes . . . where a high surface feed rate is calculated to remove a lot of metal, fast.

Or, it could be hours . . . where a slower sfm rate means a smaller pile of chips, but lengthened blade life.

The point is, every job has a different set of variables that affect performance characteristics and costs. And an essential part of our product is a study of these variables to help you develop the lowest cutter costs consistent with improved performance. We consider your machine, work piece, feed rate, depth of cut, speed and finish requirements. Only after this information is pooled with your own knowledge of the application—costs and performance of present equipment—is any cutter or grinding technique recommended.

We would welcome the opportunity to tell you more about this unique cutter selection service. Write:



This helpful new booklet tells you how to reduce the cost of chips and improve your milling and boring performance. Ask for a free copy of booklet No. 68F.

THE
INGERSOLL
MILLING MACHINE COMPANY
CUTTER DIVISION
505 FULTON AVENUE • ROCKFORD, ILLINOIS



BIG, NEW ADDITION

to SIMONDS' COMPLETE LINE of "Red Tang" Files

NEW MULTI-KUT
FLAT

This MULTI-KUT FLAT file is similar in shape to the Regular Flat File. Fast cutting, it leaves a smooth finish and gives good results on any fileable material. Furnished in 8", 10", 12" and 14" lengths.

NEW MULTI-KUT
HALF-ROUND

This MULTI-KUT HALF ROUND combines two exclusive SIMONDS file designs: Multi-Kut on the flat side, Spiral Cut on the radius side, resulting in rapid, smooth finish filing of either flat or concave surfaces or for rounding out holes. Furnished in 8", 10", 12" and 14" lengths.

NEW MULTI-KUT
SQUARE

Cut on all four sides and tapered toward the point, this fast cutting MULTI-KUT SQUARE file is especially useful in slots, keyways, splines, square holes and general surface work. Furnished in 8", 10", 12" and 14" lengths.

The New Simonds'
MULTI-KUT FILES
...with Criss-Cross Design

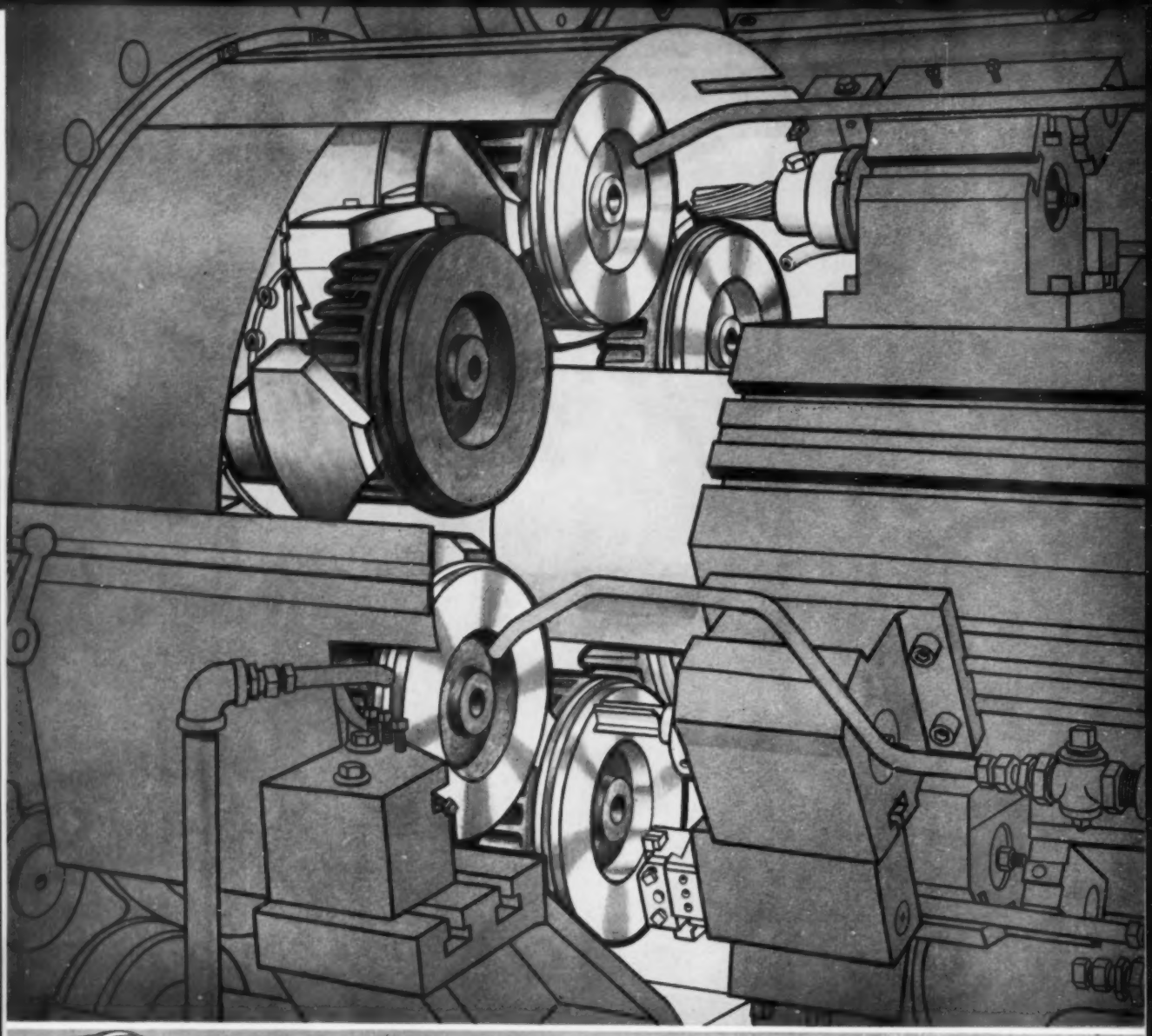
The Simonds' line of files — files that cut fast and smooth, last longer; files that bring *smiles of satisfaction* are now even more complete with the addition of Simonds' new design Multi-Kut — in three shapes, four lengths.

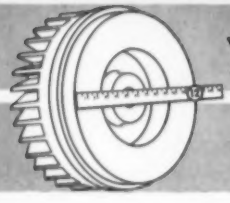
The new diamond formation chip breaking grooves and varied shapes make the Simonds Multi-Kut an extremely useful all-around file for maximum stock removal, smooth finish and long life on any fileable material.

For Fast Service from Complete Stocks
Call your
SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

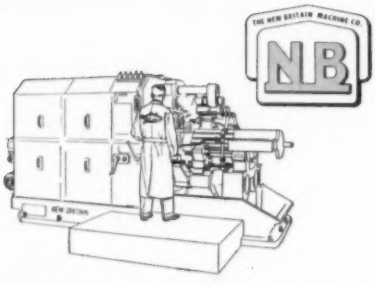
Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon . . . Canadian Factory in Montreal, Que. . . . Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada



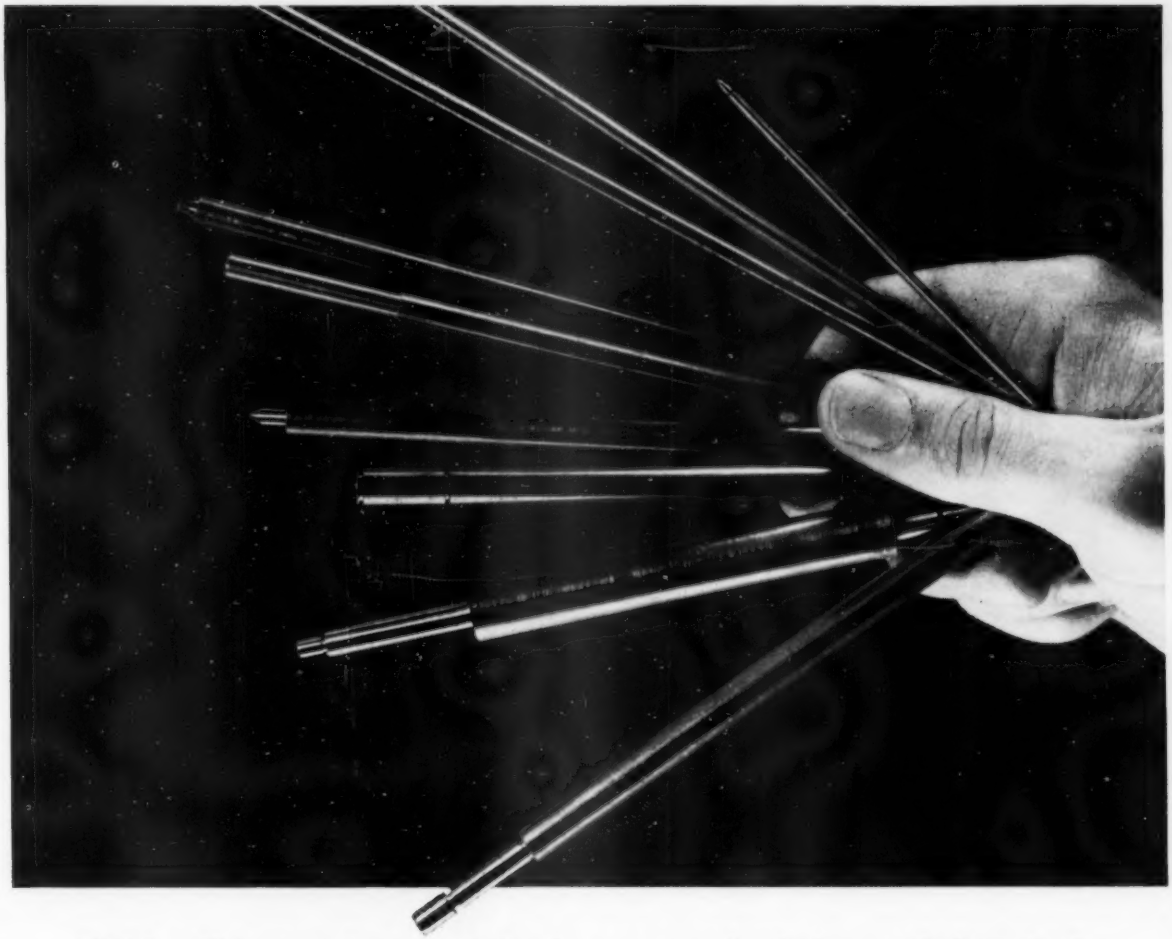


yes! you can put it on a New Britain

Now the larger pieces which formerly necessitated slower methods because of their size can be turned out at lower cost. You can, for the first time, apply New Britain standards of productivity to larger work with the *new* New Britain four-, six- and eight-spindle chuckers . . . new, larger chucking capacities (up to 15 inches), with spindle speeds, power and ruggedness to match, and all the exclusive New Britain advantages. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Chucking Machine



Which will inspect these shafts faster... mechanical or optical gaging?

Over 25 different metal shafts go into the calculators made by Monroe Calculating Machine Company.

In the past, inspection of these shafts required the use of a large number of "go" and "no-go" gages. Rate? *About 7 per minute.* In addition, gage surveillance was both time-consuming and expensive.

Then the switch was made to optical gaging, using a Kodak Contour Projector. The method is simple: A master shaft is positioned to either upper or lower tolerance limits on the screen. Then the part to be inspected is placed in the same position.

Rate with optical gaging? *About 17 per minute!* And, there's no longer a need to send gages back to the crib for resetting. One Kodak Contour Projector does the whole job.

Besides saving time, optical gaging with a Kodak Contour Projector offers you a chance to *cut* down on gage costs, use operators with little or no training, and often obtain accuracy *not* possible by other means.

Where can you use optical gaging? Almost *anywhere* in the plant—receiving, assembly, production, final inspection, toolroom.

Facts about Kodak Contour Projectors are spelled out in a brochure which you can get by writing to the address below. After you've had a chance to look over the contents of the book, we'd like to demonstrate *why* and *how* one of the six Kodak models will best fit your inspection needs.



Use of low-cost Model 8 Kodak Contour Projectors enabled the Monroe Calculating Machine Co., a division of Litton Industries, to more than double inspection rates.

Special Products Sales

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak

TRADE MARK

ADAMAS 548 CHALLENGES
YOUR PRESENT STEEL CUTTING GRADE!

A unique balance of key metallurgical properties . . . this is the difference between Adamas 548 and other steel cutting carbide grades. Let 548's metallurgical superiority prove itself on your next steel cutting job. Take your first step toward optimum carbide performance *today* . . .

(Specific Grade 548 physicals relating to hardness, density, and transverse rupture strength plus microphoto of grain structure available upon request.)

SELECT a throwaway style and size from the form below. Complete the form and request your Purchasing Department to mail it to Adamas. No invoice will be sent to you for 30 days. During this 30 day period . . .

TEST the package of ten Grade 548 inserts you receive against your present steel cutting grade.

JUDGE for yourself the performance of your 548 inserts. If for any reason you feel 548 did not outperform your present steel cutting grade, simply return all used and unused inserts and your order will be automatically cancelled . . . at no charge to you!

SEND FOR YOUR 548 PACKAGE TODAY!



CUT OUT AND MAIL

ADAMAS CARBIDE CORPORATION
DEPT. 173 KENILWORTH, NEW JERSEY

Please enter my order for 10 pieces (one package) of Grade 548 inserts . . . style and size as checked. If at the end of 30 days, for any reason I am not satisfied with their performance I will return all used and unused inserts and my order will be automatically cancelled . . . at no charge.

	BLANK ORDER NO.	I.C.	A.	T	R	PRICE	CHECK ONE
TRIANGULAR PRECISION-GROUND NEGATIVE RAKE	TB-12P22	3/8		1/8	1/32	AS PER CURRENT ADAMAS CATALOG	☐
	TB-12P32	3/8		3/16	1/32		☐
	TB-12P33	3/8		3/16	3/64		☐
	TB-16P32	1/2		3/16	1/32		☐
	TB-16P33	1/2		3/16	3/64		☐
SQUARE PRECISION-GROUND NEGATIVE RAKE	SQ-16P22		1/2	1/8	1/32		☐
	SQ-16P32		1/2	3/16	1/32		☐
	SQ-16P33		1/2	3/16	3/64		☐
	SQ-24P32		3/4	3/16	1/32		☐
	SQ-24P33		3/4	3/16	3/64		☐
	SQ-24P34		3/4	3/16	1/16		☐

I would like a style (or size) other than listed above
Please send me:_____

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

GRADE 548 IS SPECIFICALLY RECOMMENDED FOR MACHINING: LIGHT TO MEDIUM CUTS, LIGHT INTERRUPTED CUTS

Tough Alloy Steels:

3000	300 Stainless
4000	400 Stainless
5000	Tool Steels
6000	Monel
52100	Inconel
8600	Nitraloy

ADAMAS
CARBIDE CORPORATION
KENILWORTH, NEW JERSEY
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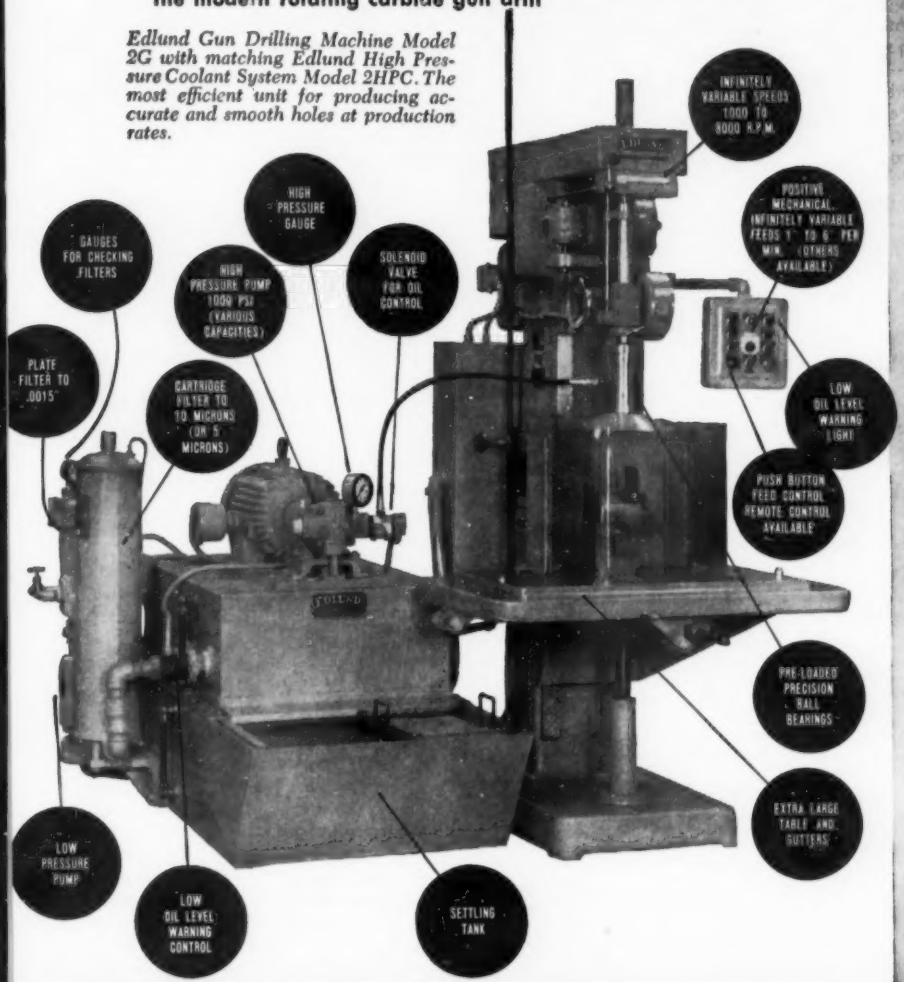
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GRINDING METHODS

Self-dressing wheels and high-powered surface grinders eliminate inefficiencies when machining flat surfaces!

EXAMPLE: 4140 steel forgings, formerly milled at 33 per hour, are now ground on a Mattison No. 24 Vertical Rotary Surface Grinder at 58.6 per hour. Tool replacement cost has been reduced from 39¢ per piece to 4¢. Total part cost was cut from 54¢ per piece to 11¢. Automatic sizing and self-dressing wheel help minimize nonproductive machine time.

When you have flat surfaces to machine, let Mattison evaluate cost reductions and accuracy improvements made possible by high-powered surface grinding.

With recent improvements in grinding wheels—and Mattison has backed them up with increased horsepower at the spindle and plenty of machine rigidity—many jobs which were formerly machined by other methods are being done more efficiently on a surface grinder. For, modern grinding methods permit you to remove up to ¼-in. stock from the rough, with accurate size control and fine finish, holding flatness and parallelism within very close limits.

Cost of the cutting tool is not in the price

By using open-structure wheels which automatically release their grits when they get dull, and with automatic sizing to compensate for wheel wear, you get true perishable tool efficiency. A glance at the table below will show you how reductions in tool-sharpening cost and change time helped trim 43¢ off the cost of forged chain links. Whatever the cost of the wheel, you can afford to use it at maximum efficiency. You never have to "baby" the cutting tool by slowing down your machines. There's no worry about hard spots. You can grind before or after heat-treating.

How to absorb loading time into the production cycle

Many flat surfaces on castings and machine parts can be rough and/or finish-ground on a standard surface grinder at 100 per cent efficiency.

Whenever machining time and loading time are equal, you can absorb loading cost into the production cycle with a duplex table. Using self-dressing wheels and automatic sizing, the Mattison Duplex Rotary gives you remarkable efficiency on a standard machine, plus all of the rigidity needed for high stock removal and generation of accurate surfaces with the wheel set "dead flat."

Tolerances getting tighter

Many companies are switching to surface grinders to combine the advantages of rapid stock removal and accurate size control. On thin-walled parts, particularly, you can eliminate distortion while the part is being ground, holding accuracy within "tenths" limits. The torque converter housing (Fig. 1) is a good example. An open section in the casting made it difficult to mill without springing the ends. Now, flatness and parallelism are easily held within .0015 in.



***Fig. 1**—Saves two milling operations, finish grinding difficult-to-machine castings to close tolerances. Mattison Duplex Rotary Surface Grinder removes .060 to .070 in. stock from top and bottom surfaces of grey iron castings at the rate of 17.4 pieces per hour. One operator and one machine easily do the work formerly requiring two machines.*



***Fig. 2**—Grinding time cut in half on the Mattison "Duplex," roughing Maxel steel shanks for carbide-tipped milling cutter blades. One operator and one machine now do a job that formerly required two operators and two machines. Stock removal is .050 in.*

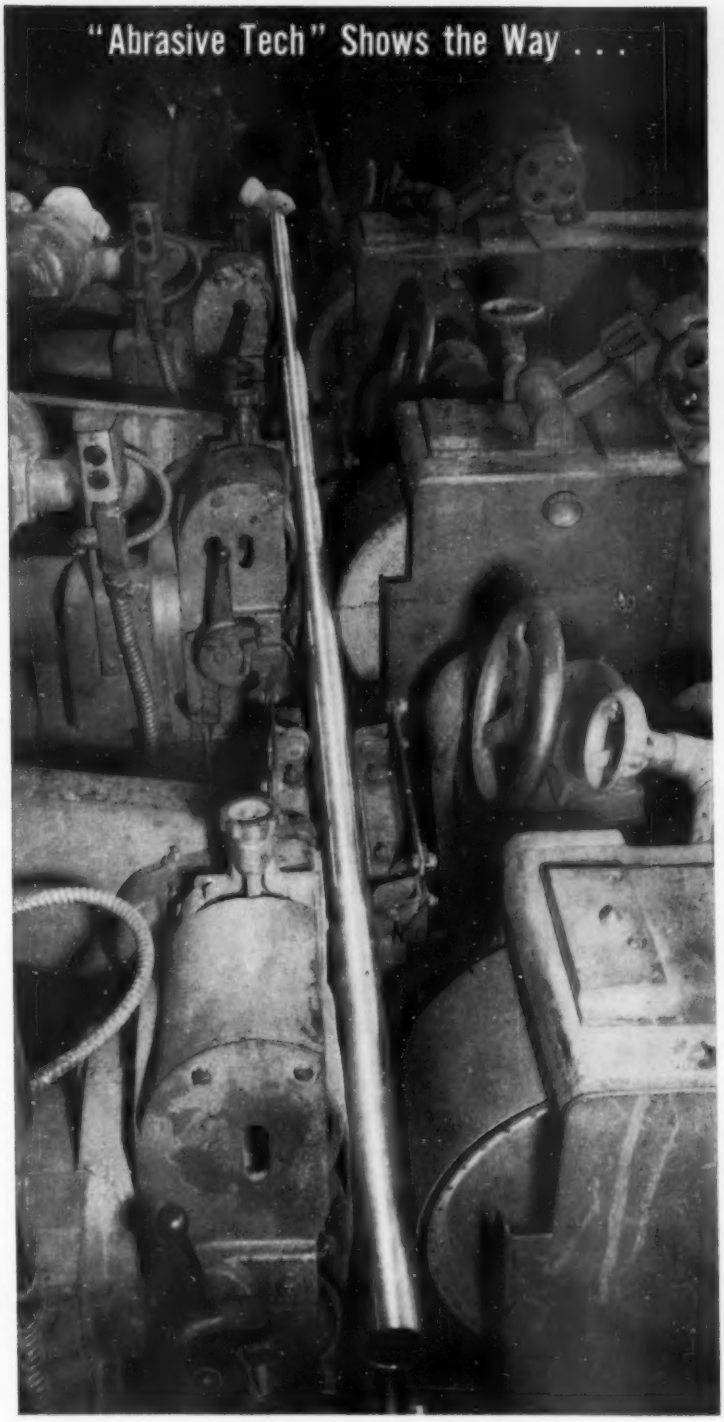
MACHINING COSTS and PRODUCTION RATES (4140 steel forging)

Machine	Milling Machine	Surface Grinder
PRODUCTION RATE Pieces per hour	33	58.6
(1) MACHINING COST Machining time x (labor + overhead) = (min) x ($ per min)	$.13 per piece	$.05 per piece
(2) TOOL OR WHEEL REPLACEMENT COST (a) Tool or wheel change cost (b) Tool or wheel depreciation cost (c) Tool or wheel sharpening cost	$.15 per piece $.0835 per piece $.16 per piece	$.04 per piece
TOTAL	$.3935 per piece	$.04 per piece
(3) NONPRODUCTIVE COST Loading time x (labor + overhead) = (min) x ($ per min)	$.02 per piece	$.023 per piece
TOTAL MACHINING COST = (1) + (2) + (3)	$.543 per piece	$.113 per piece
SAVING = $.43 per piece		

Try before you buy

Our engineers will be happy to test grind your flat pieceparts in the Mattison Methods Laboratory. Results of the test will be reported to you in the form of a complete cost evaluation, including production rate, tooling, type of machine best adapted to your work, finish, accuracy, wheel specifications, wheel consumption rate, etc. They will set the job up and demonstrate to you in Rockford the savings made possible on a high-powered surface grinder. There's no obligation—contact your local machinery dealer, or write to:

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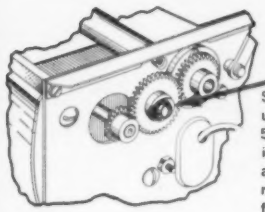
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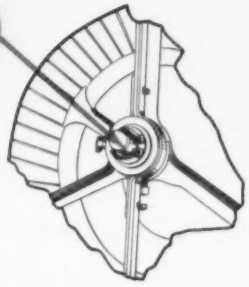
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Sanborn Co., Waltham, Mass., uses a Waldes Truarc Series 5555 Grip ring* to secure the idler gear assembly of its portable electrocardiograph. The ring assures faultless gear performance necessary for diagnostic accuracy; eliminates a nut and threading operation for savings of $365 per 1000 units.

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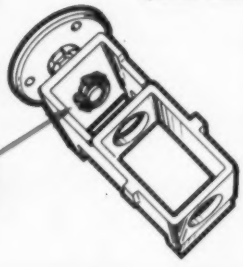
Fraser and Johnston Co., San Francisco, Calif., uses a Series 5555 Grip ring* to secure the fan shaft and speed assembly of its furnace blowers. The ring eliminates a collar and set screw for savings of $180/M on materials, $80/M on assembly time—a total of $260 per 1000 units.

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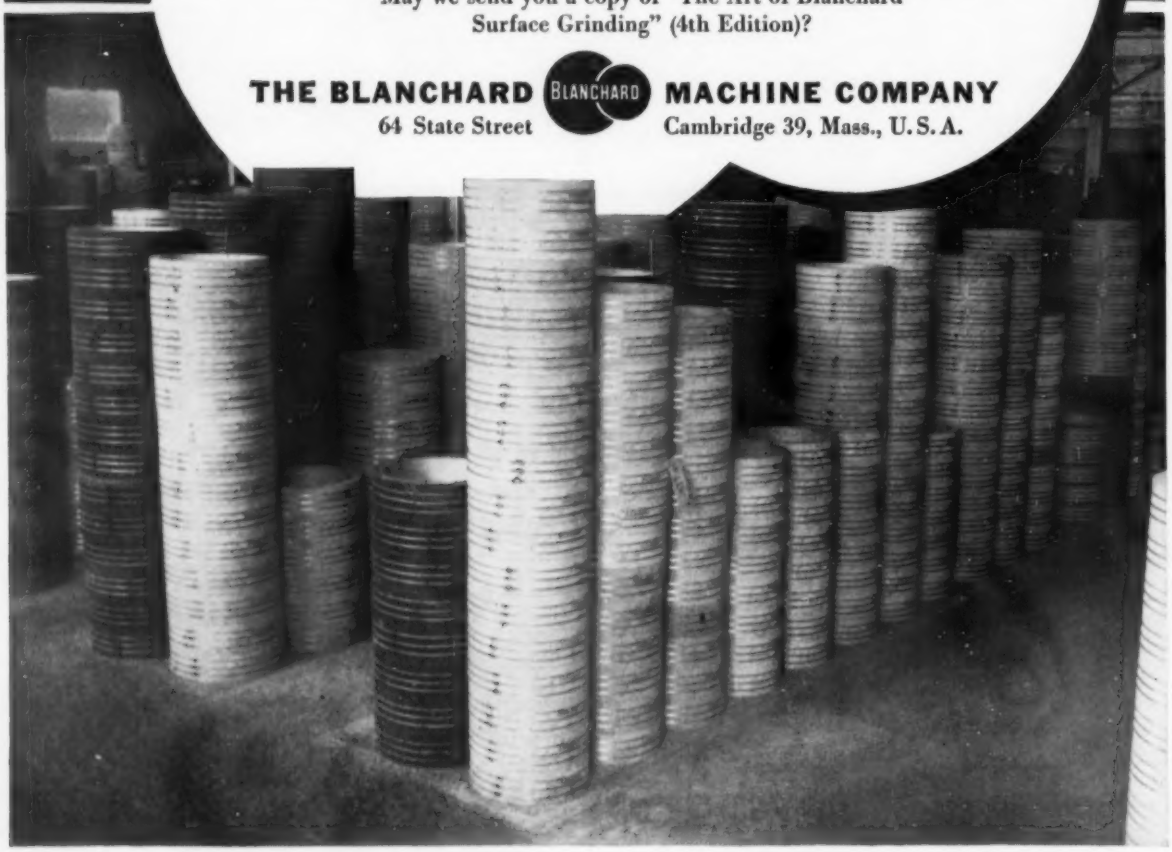


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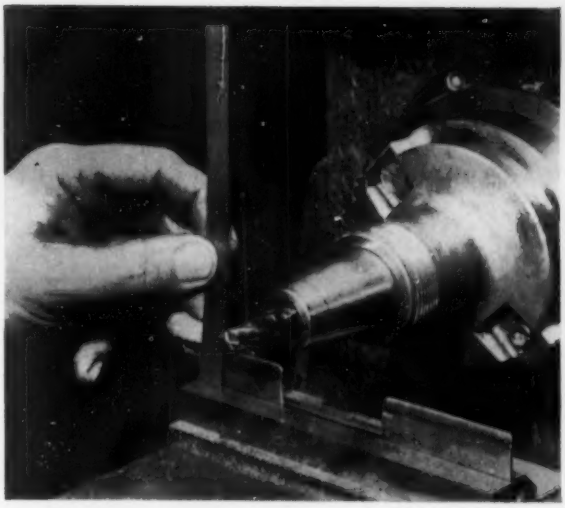
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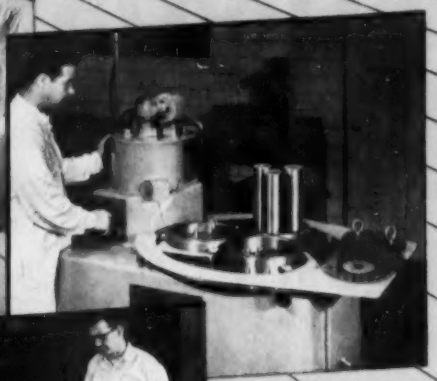
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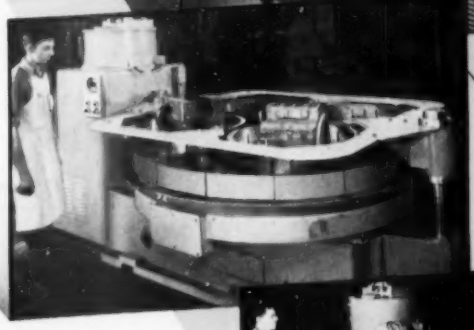


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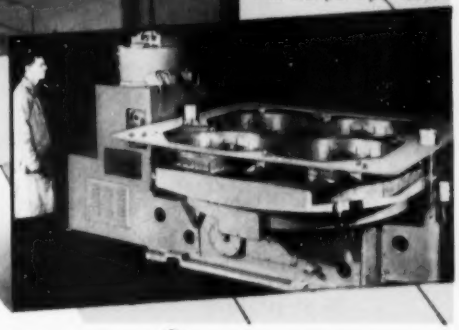




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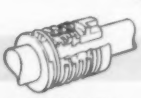
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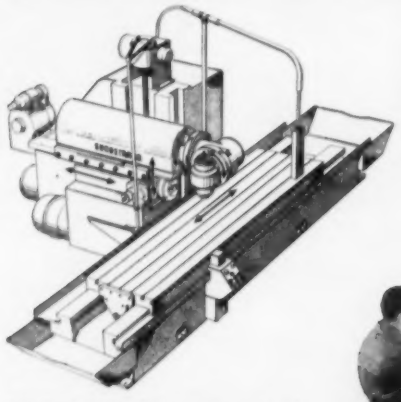
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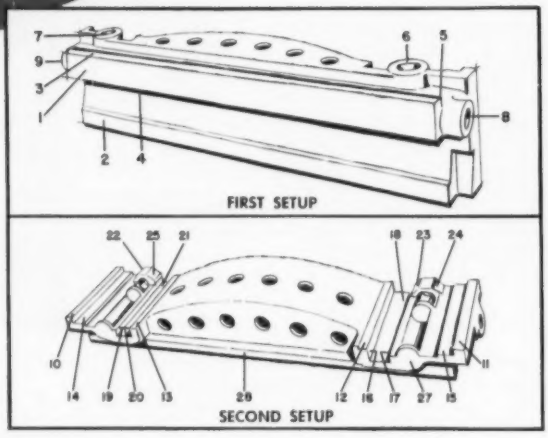
THREAD COMPOUNDS

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SUNDSTRAND 50-hp machines 28



Arrowheads on sketch show movements and adjustments of machine elements that make this universal bed-type Rigidmil with All Angle head exceptionally versatile



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Positioning cutter instead of work reduces setup time

HERE'S HOW TO CUT SETUP TIME . . . Sizable cuts are taken with both the All Angle head and the main horizontal spindle so that production rate stays high despite the unparalleled flexibility. Carbide cutters are used to full advantage on both spindles as shown in typical operations below. Accuracy invariably exceeds that possible on conventional machines because of reduced parts handling. Surfaces 1 to 9 machined in first setup. Surfaces 10 to 28 machined in second setup.



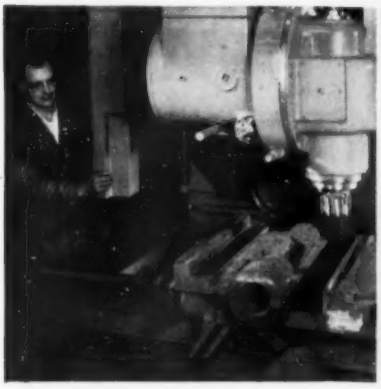
HORIZONTAL SPINDLE and longitudinal table feed are used for face milling first surfaces of large casting.



MACHINING ON TOP of the work is illustrated in this example using the All Angle head and longitudinal table feed.



ANOTHER EXAMPLE of the ease with which it is possible to move the cutter instead of workpiece is on this step using All Angle head and vertical feed.



ANOTHER POSSIBLE combination of machine movements is shown here where All Angle head in vertical position is coupled with transverse feed.



ALL ANGLE HEAD is used to mill clearance cuts at an angle using transverse feed. All power feeds are infinitely variable.



HORIZONTAL SPINDLE returns to action in combination with longitudinal table feed. Power operated drawrod (extra) for horizontal spindle makes cutter changing easier.

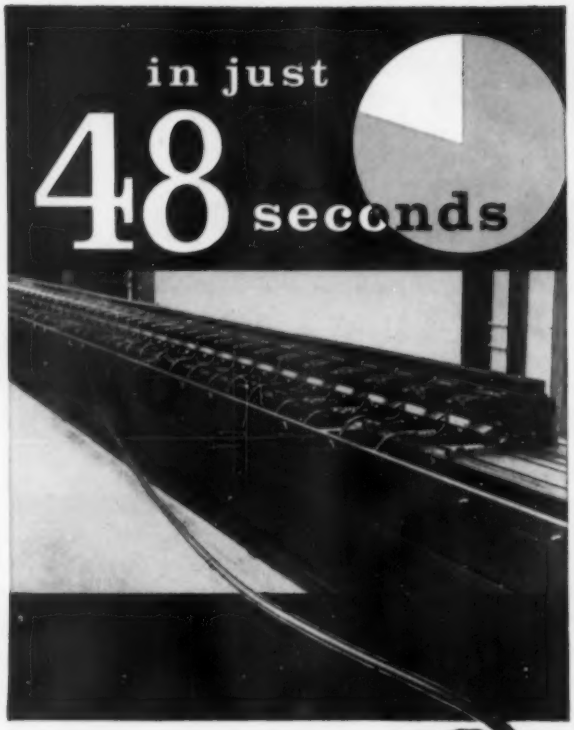
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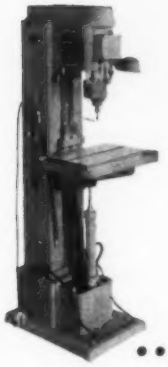
ANOTHER SERVICE to ASTE Members

Everyone who subscribes to THE TOOL ENGINEER can look forward to receiving a very special bonus issue on June 15, 1959. The SUPPLIERS DIRECTORY ISSUE will present the industry's most complete and up-to-date guide to product information sources available anywhere. Whenever a tool engineer needs to know more about the specifications, prices, availability or functions of a given product, the SUPPLIERS DIRECTORY will guide him to the nearest *local* source of such information. As an issue of THE TOOL ENGINEER, the Directory will not be lacking in technical editorial content. Articles are planned to include such topics as Cost Estimating and Numerical Coding of engineering products. And, all of this will be provided at no additional cost.



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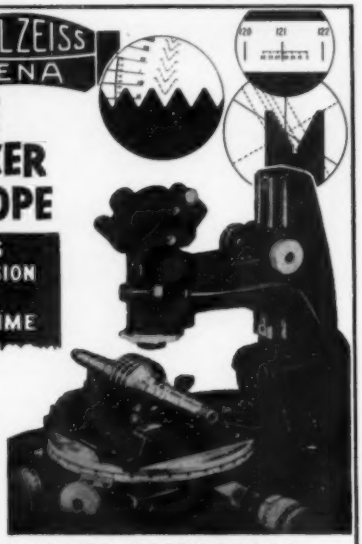
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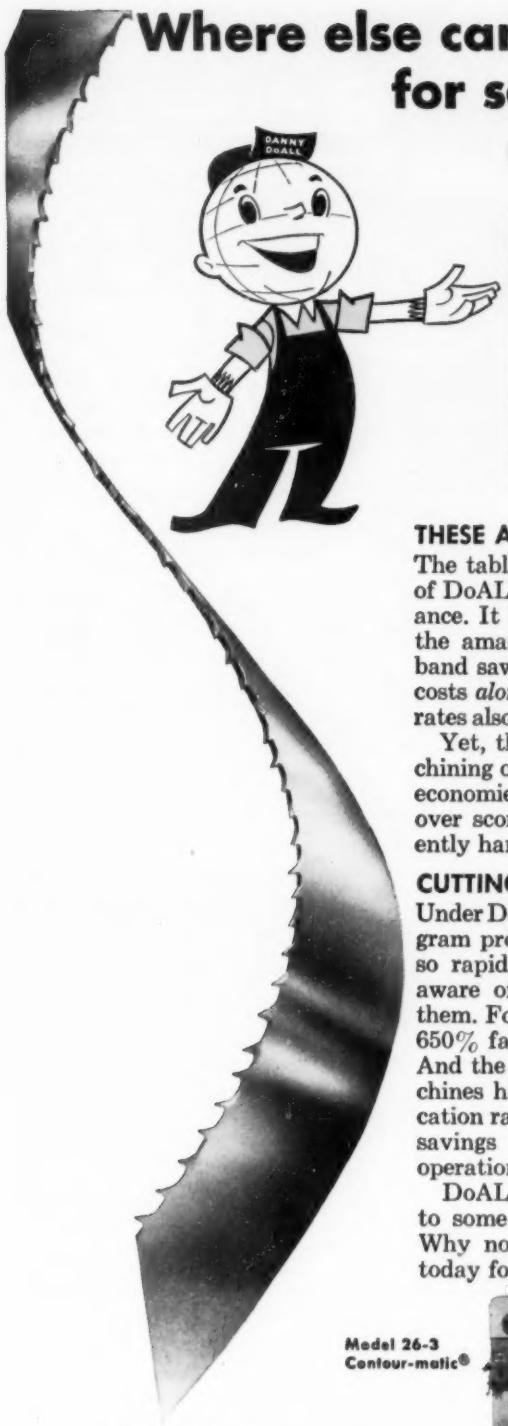
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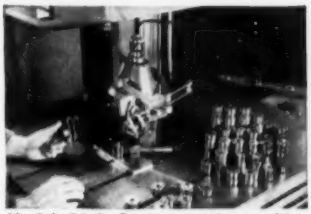
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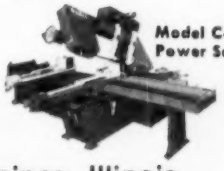
Power Saw Model C-58 cutting 3¼" diameter AISI 1015. Tool cost $1.54 per 100 cuts.



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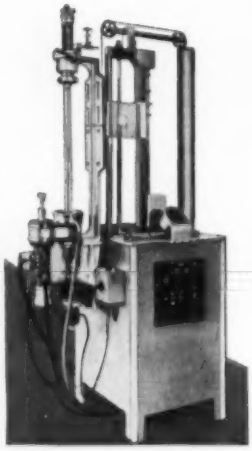
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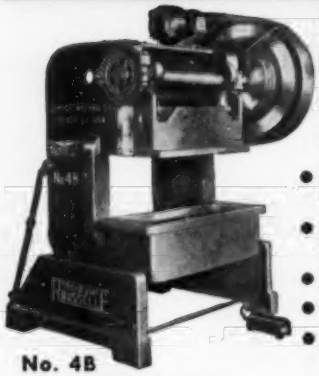


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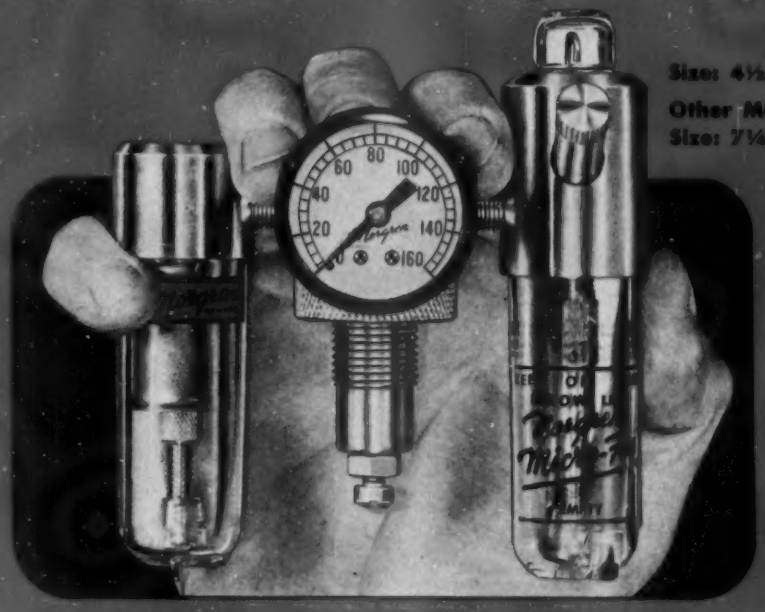
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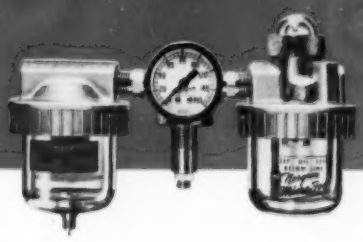


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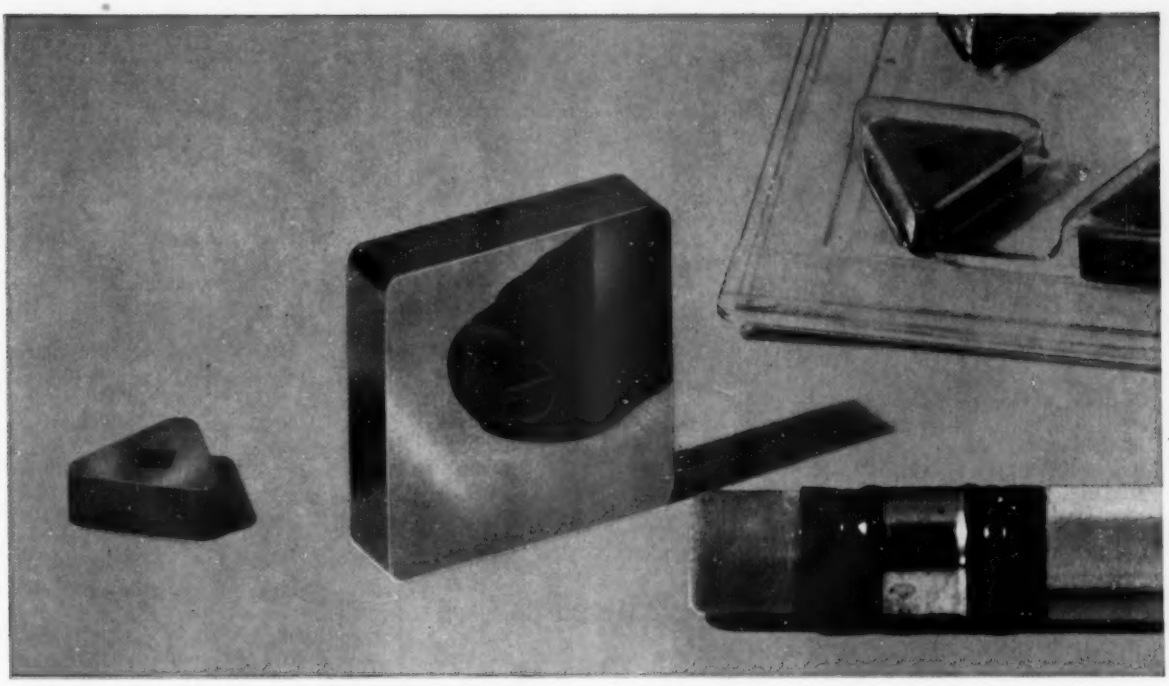
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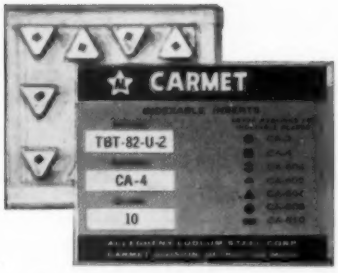
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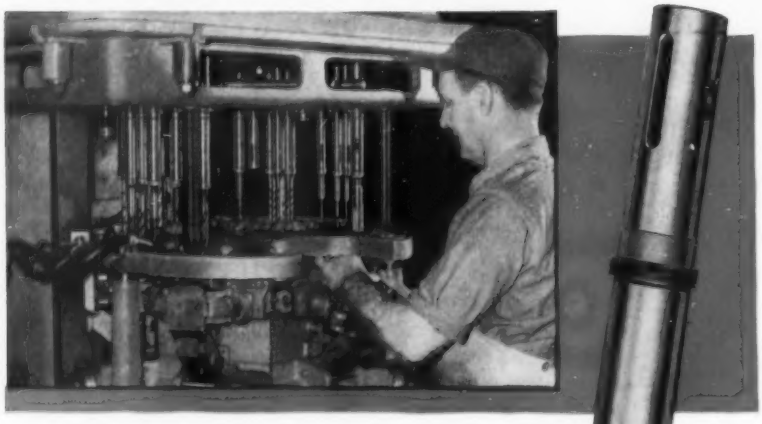
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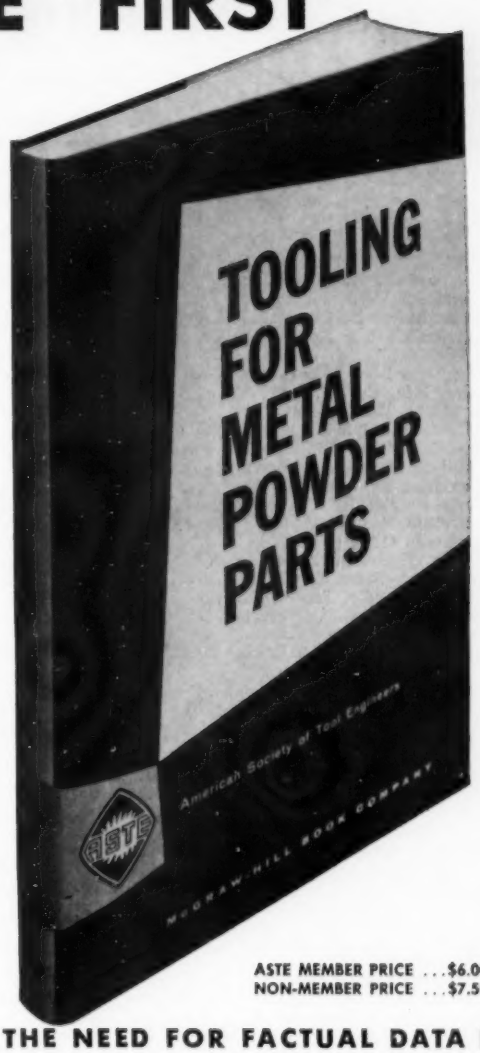
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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

At the start of the new year, many industry leaders predicted that 1959 would be a year of full economic recovery from the recent recession. Others, while forecasting a continued upward trend, feel that full recovery will take several years.

Suppliers of raw materials are optimistic. Spokesmen for Allegheny Ludlum Steel Corp. foresee a better year for the steel industry than 1958. The need for stainless and specialty steels is growing. Tool steel shipments for 1959 should be about 100,000 tons, a substantial increase over 1958 and a return to the relatively high level of 1957.

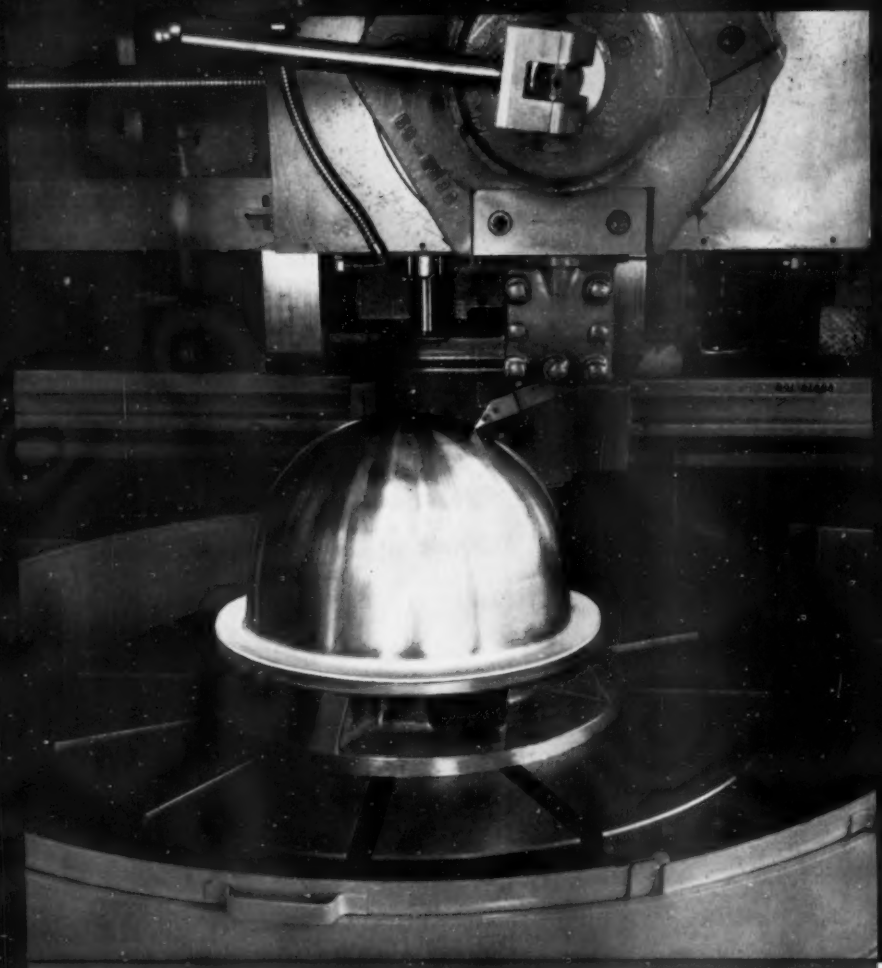
According to marketing experts at Titanium Metals Corp., 1958 marked the first year in the eight-year history of large-scale production of titanium that production increases were not recorded. However, market diversification indicates that the industry is on a solid base. Titanium is now being used on commercial aircraft and the price of typical titanium mill products has been cut in half.

The Society of the Plastics Industry notes that production of plastics increased five percent in 1958 and predicts a 250,000-ton increase in the coming year.

Greater capital expenditures for 1959—and thus better business for the over-all economy and the metalworking industry in particular—are forecast by the president of Standard Pressed Steel Co. He notes that all segments of the metalworking industry will be participating in the upswing by mid-1959.

A less optimistic note has been sounded by the National Tool & Die Manufacturers Association. They expect business conditions in the tool and die industry to increase only about 15 percent in 1959, which would be less than the average for the past five years. An upswing in requirements for farm equipment has led to better business for tool and die companies serving that field, but requirements for the automobile industry have fallen off. On the basis of tool and die orders, it appears that the automobile industry as a whole is planning no major model changes for 1960. The aircraft industry, currently going through the change-over from manned aircraft to missiles, does not have high requirements for production type tooling at the moment. Best bets for tool and die companies are customers in the electronics, appliance and business machine fields.

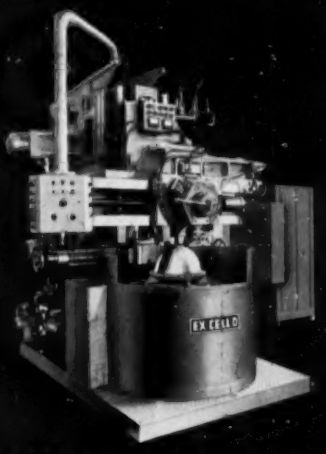
The year 1958 pointed up the value of continuing research and the high cost of operating with obsolete facilities and equipment. Companies with needed new products and efficient new plants generally managed to hold their own, even advance, during the year.



XLO

EX-CELL-O FOR PRECISION

LEFT: Single tracer-controlled tool contours aluminum forging to .080" wall thickness holding .001" tolerance inside and outside.



ABOVE: Compact Vertical Contouring Machine handles medium or large workpieces. Slim cabinet at right side holds electronic tracer controls.

Critical Contour Tolerances?

HOLDS WITHIN .001" OF TRUE CONTOUR—INSIDE AND OUT



Close-up shows Style 416 contouring the inside surface. Workpiece is held in a vacuum fixture mounted on the machine table.

58-7

Contouring within .001" of true contour—inside and out—*without waste* requires the kind of precision built into an Ex-Cell-O Style 416 Vertical Contouring Machine.

The aluminum forging illustrated was first contoured on its periphery with a single electronic-tracer-controlled tool, then precision-finished inside to .080" wall thickness.

Designed for contouring hemispherical or irregularly-shaped surfaces, Ex-Cell-O Style 416 Machines also face, bore, turn, groove and chamfer with automatic cycling between loading and unloading.

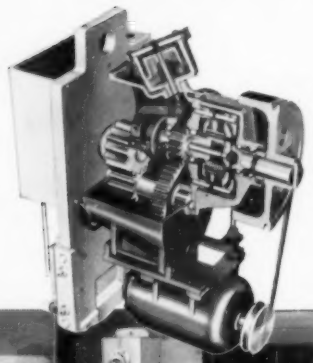
Call your local Ex-Cell-O Representative, or write directly to Ex-Cell-O for information on other Precision Vertical Boring Machines.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Here's Why Clearing's Torc-Pac O.B.I. Is The Most Practical, Most Versatile Press Available Today

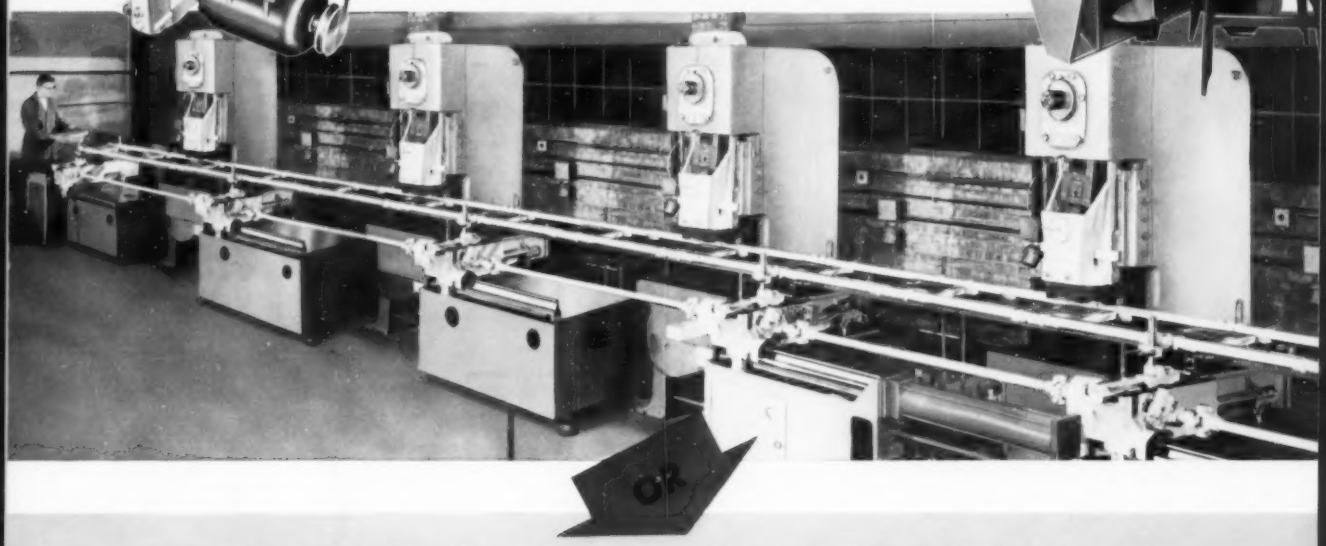




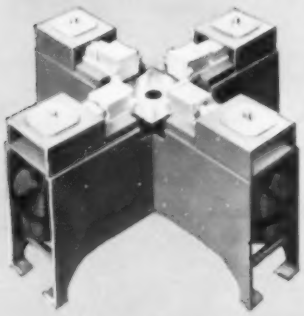
The removable drive and slide unit shown at left contains the most maintenance-free air friction clutch and brake ever built for an O.B.I.

An extra drive unit can be used as a replacement to take care of maintenance of Torc-Pac O.B.I.'s in your shop.

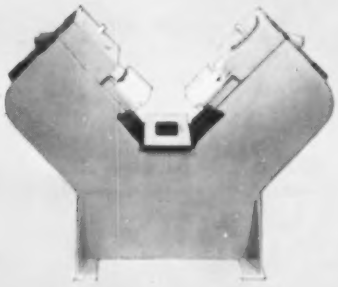
Torc-Pac O.B.I.'s can be used with special Clearing feeds to give you a completely automated stamping line . . .



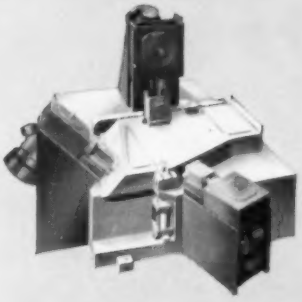
Torc-Pac drive and slide units may be used to develop your own "Power Tooling" by mounting directly to fixtures, or by using easy to build special-purpose frames as shown in the models below.



4 Torc-Pac drives used horizontally in a unit like the above.



2 drive units give you the arrangement above.



3 units give you "Power Tooling" as shown above.

Manufacturers of Presses, Dies, Lathes and Special Equipment for Aircraft and Missile Industry.

Write for specifications and additional facts on Torc-Pac



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